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ABSTRACT

This curriculum guide prescribes the minimum course content for all mathematics programs in the public schools of the State of Alabama. It forms the basis for the development, by local education agencies, of all state mathematics programs. Minimum course content for each grade has been organized into seven content areas: number, measurement, geometry, algebra, patterns and functions, logic, and statistics and probability. Instructional objectives and student outcomes related to problem solving, the use of calculators and computers, the practice of estimation and mental arithmetic, and the development of language facility are interwoven into every grade level and/or course. Minimum course content for each grade level is presented as student outcomes which consider the developmental characteristics of learners and the developmental nature of mathematical concepts. This guide is divided into the following sections: (1) "Introduction"; (2) "Trends, Issues, and Position Statements"; (3) "The Elementary Program in Mathematics"; and (4) "The Secondary Program in Mathematics." Appended are the time requirements for subject areas and study habits, homework, and student responsibilities. (KR)

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Alabama Course Of Study

MATHEMATICS

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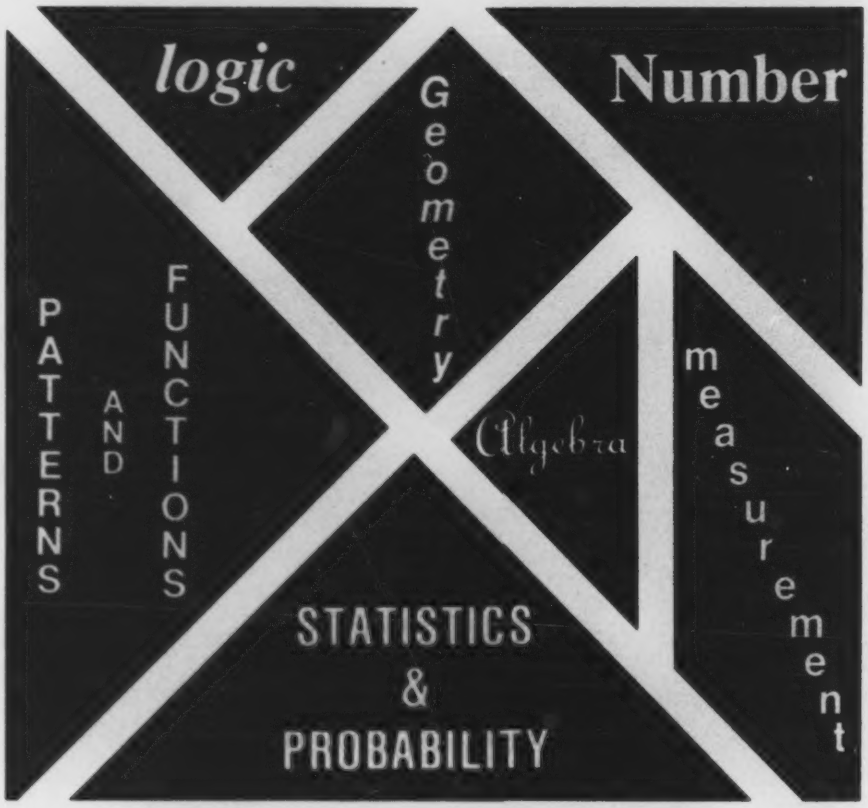
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Geometry
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&
PROBABILITY

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Wayne Teague
State Superintendent of Education

ALABAMA STATE DEPARTMENT OF EDUCATION
MONTGOMERY, ALABAMA 36130

BULLETIN 1989, NO. 31

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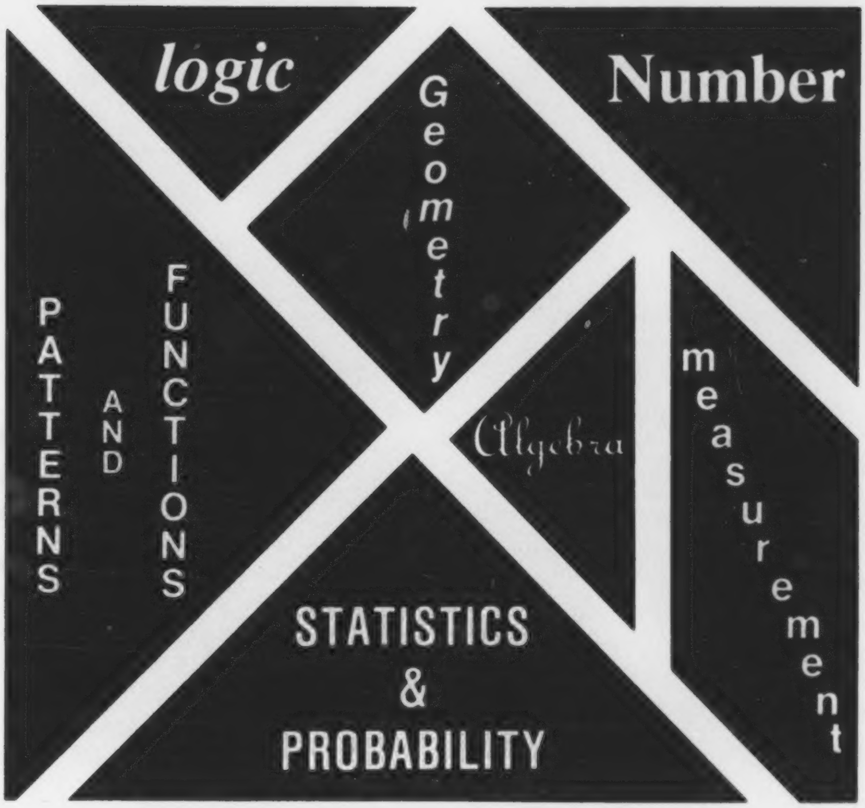
MATHEMATICS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PREFACE

The Alabama Course of Study: Mathematics prescribes the minimum course content for all mathematics programs in the public schools of the state of Alabama. It is the basis from which mathematics programs are developed by local education agencies.

The development of Alabama State Courses of Study is required by law (Code of Alabama, Title 16, Chapter 35, Section 1). The content of the Alabama Course of Study: Mathematics was adopted by the Alabama State Board of Education on June 8, 1989. Local education agencies are expected to develop local curriculum plans inclusive of the state-prescribed content, but designed to meet the needs of their specific student populations.

ACKNOWLEDGEMENTS

Many persons have contributed to the development of this course of study. The committee, composed of classroom teachers, supervisors, principals, and representatives of institutions of higher education with consultative assistance from Alabama State Department of Education instructional specialists has worked with dedication and pride. The committee members' cooperation and commitment to the task are appreciated.

Eddie B. Thomas, Chairperson
Assistant Superintendent
Tuscaloosa City Schools

Loette Lee, Vice-Chairperson
Montgomery County

Martha Jane Ahrens
Brewton City

Jo Ann Bedwell
Selma City

Mary T. Birdwell
Hoover City

Donna K. Boyd
Russellville City

Ricky D. Brown
Scottsboro City

Willie H. Christian
Auburn University at Montgomery

Valra G. Goshea
Phenix City

Brenda W. Jones
Vestavia Hills City

Martha L. Laster
Huntsville City

Mari-Ann Roth, Vice-Chairperson
Tuscaloosa City

Suzanne McGill
University of South Alabama

Marian Alice Moody
Oxford City

Janet M. Overstreet
Thomasville City

Catherine M. Poellnitz
Henry County

Marlin Raney
Cullman City

Lynnette C. Rushing
Shelby County

Micheal M. Teal
Barbour County

Hoyt E. Taylor
Alabama A & M University

Betty O. Thomas
Baldwin County

Moses Clark, Dorothy DeMars, Linda Harris, Frank Heatherly, Barbara McMillin, Rosemary Mobley, Linda Pledger, and Regina Stringer, Instructional Specialists, Alabama State Department of Education, served as consultants to the committee.

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ALABAMA COURSE OF STUDY
MATHEMATICS

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INTRODUCTION

The Alabama Course of Study: Mathematics is intended to prepare mathematically literate citizens for the Twenty-first Century. In its publication, Curriculum and Evaluation Standards for Mathematics and Schools, the National Council of Teachers of Mathematics (NCTM) recommends that emphasis on problem solving, communication, and mathematical reasoning be reflected in kindergarten through grade twelve. In Agenda for Action: Recommendations for School Mathematics of the 1980's, NCTM recommends that problem solving be the focus of school mathematics, that basic skills in mathematics encompass more than computational facility, and that mathematics programs at all grade levels take full advantage of the power of calculators and computers.

The Alabama Course of Study: Mathematics, in keeping with these recommendations, is a broad, sequentially-developed outline for mathematics instruction in grades K-12. Minimum course content for each grade has been organized into seven content areas: Number, Measurement, Geometry, Algebra, Patterns and Functions, Logic, and Statistics and Probability. In addition, instructional objectives and student outcomes related to problem solving, the use of calculators and computers, the practice of estimation and mental arithmetic, and the development of language facility are interwoven into every grade level and/or course.

Minimum course content for each grade level is presented as "student outcomes," i.e., that which students are expected to learn as a result of instruction. In writing these outcomes, every attempt has been made to consider the developmental characteristics of learners and the developmental nature of mathematical concepts. The assignment of particular outcomes to a grade level reflects the committee's consensus that most students in that grade level can work toward achieving the outcomes even though the degree of mastery will vary. It is essential that classroom teachers implement the Alabama Course of Study: Mathematics in a manner appropriate for the individual students in their classrooms. Teachers at all grade levels will need a knowledge of content in preceding and subsequent grade levels if they are to instruct in a manner compatible with the characteristics of each learner and with the developmental nature of mathematics.

RATIONALE AND DEFINITIONS OF TERMS

IDENTIFICATION OF CONTENT AREAS

To bring emphasis to particular topics and to ensure developmental sequence the Alabama Course of Study: Mathematics organizes student outcomes in seven areas. It is not intended that these areas be taught as separate entities, but that they be integrated instructionally within the classroom. Organization of content into these areas helps to ensure a smooth transition between K-8 programs and course offerings in high schools. It also allows for emphasis to be placed on topics such as logic and statistics and probability that have received little attention in previous mathematics courses of study. A brief definition and description of the seven content areas follows.

Number. The study of number involves more than the development of computational skills and recall of facts; it also involves the study of concepts and principles. The goal of a study of number is to promote mathematical understanding of arithmetic operations. Emphasis should be placed on both computation and conceptual understanding. The system of numbers should be presented as a system of expanding ideas, beginning with the set of counting numbers and culminating with the set of complex numbers. Encounters with all systems of numbers should begin with concrete experiences and progress to abstract concepts.

Measurement. Measurement is the process of assigning a numerical unit to represent the size of an object or set. It can be considered a special example of a function. Measurement includes selecting appropriate units, applying measurement concepts, and communicating measurement-related ideas to others.

Geometry. Geometry provides a visual approach to the study of mathematics. By observing, describing, analyzing, and testing physical phenomena, students gain insights into all branches of mathematics. The development of geometric principles and understandings are modeled through various aspects of the physical world with instruction gradually progressing toward a more abstract level. Generally, the study of geometry begins with the two-dimensional plane and progresses to three-dimensional space. However, this order does not always hold, i.e., young children may be more familiar with a ball than with a circle.

Algebra. Algebra is defined as the generalization of arithmetic in which symbols are used to represent numbers or members of a specified set of numbers. The set of numbers is defined by basic properties of operations that hold for all numbers in the set. In grades K-6, major themes in the area of algebra include the notion of a variable, the order of operations, the solution of some equations and inequalities, and the writing of statements to represent given problems or number patterns. Investigation of these themes is prerequisite to the study of higher mathematics.

Patterns and Functions. The recognition of patterns in everyday life and in the pairing of sets is an introduction to the development of the concept of functions. Recognizing patterns and forming generalizations are effective tools in problem solving. The study of patterns begins with activities that focus on concepts such as symmetry, similarity, congruence, and repetition. Work with numerical, geometric, and algebraic patterns helps students develop inductive reasoning. The integration of algebra and geometry facilitates the visual perception of functions and relations.

Logic. Logic is the basis of all mathematics because it can be applied to all branches of mathematics. It is both a prerequisite and a desired outcome of mathematics instruction. Instruction in logic begins in the elementary grades as students are asked to recognize patterns, organize ideas, classify data, understand terms such as "all" and "some", recognize the application of a principle, draw conclusions, and make inferences. At the secondary level, students have opportunities to distinguish between and use inductive and deductive reasoning; they also learn to draw conclusions and to apply formal and informal principles of logic in all mathematics courses.

Statistics and Probability. Technological advances have resulted in the production of large quantities of data. Statistical data are used to influence decision making; therefore, the interpretation, analysis, and understanding of statistical data are crucial. Statistics and probability involves gathering, displaying, and analyzing data. It also involves the application of data analysis to decision making.

EMPHASES IN K-12 PROGRAM

Certain topics have been identified as key elements in the mathematics education of students. When programs are structured to include emphasis on these topics, the study of mathematics can provide students with opportunities for experiencing enjoyment and success. These topics are:

1. Problem solving
2. Appropriate uses of calculators and computers
3. Skill in estimation and mental arithmetic
4. Development of language facility

In the Alabama Course of Study: Mathematics, student outcomes in all grades and courses emphasize the development of a wide range of problem solving strategies. The application of mathematical knowledge and skills to the solution of problems encountered in everyday life is present also. The Alabama Course of Study: Mathematics requires students to perform calculations in the many different ways they are performed in society today, i.e., by mental arithmetic and with paper/pencil, calculators, and computers. Students are challenged to select an effective and appropriate method of calculation when solving problems and are expected to estimate quantities in situations when precision is unnecessary and time-consuming.

Throughout the seven content areas and in all grade levels, language development is an integral part of the mathematics course of study. Students are required to learn the language of mathematics, to describe verbally what they see and understand, and to write about these observations. For these reasons, the emphasis on problem solving, the uses of appropriate methods of performing calculations, and the development of language facility are viewed as strands that weave throughout the K-12 mathematics program.

TRENDS, ISSUES, AND POSITION STATEMENTS

CORE CURRICULUM

Research consistently reflects the need for all students to be knowledgeable in the areas of algebra and geometry. The Alabama Course of Study: Mathematics describes course content and sequence that have the potential of preparing more students to study algebra and geometry successfully during their high school years. As the K-8 mathematics curriculum changes are implemented, more students will pursue a core curriculum in grades 9-12 that includes either Algebra I, Unified Geometry, and Algebra II or General Mathematics, Algebra I, and Unified Geometry or Algebra II.

OPPORTUNITY TO LEARN

A clear trend in mathematics education today is to provide all students with equitable opportunities to participate in a variety of organized learning experiences designed to prepare them for success in the study of mathematics. This is essential if females are to achieve as well as males and if minorities are to achieve as well as the majority population. While the Alabama Course of Study: Mathematics is a presentation of content, it is expected that local education agencies (LEAs) will deliver that content in ways that increase significantly the success rate of all students. Specifically, it is expected that teachers use a variety of instructional techniques having proven motivational value and high expectations for success, i.e., use of calculators to perform cumbersome computations, competitive situations, cooperative learning techniques, strategies that accommodate student learning styles. Moreover, LEAs are expected to provide all students with the instructional materials and equipment needed to fulfill the program objectives outlined in this document.

CHANGES IN SEVENTH- AND EIGHTH-GRADE MATHEMATICS

The need for change in the mathematics curriculum is nowhere more acute than in the seventh and eighth grades. In order to prepare students to function adequately in a technology-dominated society, emphasis needs to be placed on the application of computational skills in prealgebra and pregeometry.

In the Alabama Course of Study: Mathematics, prealgebra skills are emphasized in the seventh grade, and pregeometry skills are emphasized in the eighth grade. While course content in these grades has been strengthened considerably over previous courses of study, it is believed that junior high school students will be better prepared by the elementary school curriculum in the next few years. Specifically, it is expected that students demonstrate proficiency in basic operational skills with whole numbers by the end of fourth grade and that they have a minimal proficiency in basic operational skills with fractions and decimals by the end of sixth grade. Consequently, entering seventh grade students should be better problem solvers and better communicators. These changes will pave the way for a broader range of topics in mathematics to be addressed during the junior high school years.

CHANGES IN GENERAL MATHEMATICS

Studies show that far too many students leave school without having acquired the mathematical power necessary for productive lives. For this reason, a three-year core curriculum for all students is being recommended by the National Council of Teachers of Mathematics. This core curriculum would provide the following opportunities for the less successful students:

- An open door to college programs and vocational training,
- Better preparation for the world of today and tomorrow,
- Participation in more interesting and important mathematics, and
- A fresh approach to mathematics that builds on what students can do rather than on what they cannot do.

In an effort to move toward a three-year core curriculum, the General Mathematics course in this document has been strengthened to include more topics related to algebra and geometry.

REPETITION OF CONTENT

Excessive repetition of content in mathematics courses is undesirable. According to the Flander's Study, a high percentage of mathematics content in grades K-8 traditionally has been repetitious material. Such repetition hinders students' progress in mathematical development.

In the *Alabama Course of Study: Mathematics*, some outcomes appear in two consecutive grade levels. These outcomes are stated in broad terms and are worded to avoid dictating the manner in which LEAs must approach the teaching of a topic. In other instances, the wording of outcomes suggests that several years may be required before students demonstrate mastery of a particular topic. Allowing students time to develop proficiency is different from exposing all students to endless review and repetition. This document encourages review and repetition that is individualized and limited to those skills and concepts necessary to understand new material.

NEED FOR REMEDIATION

In order to ensure continuous learning for all, deficiencies should be identified and remediation provided as soon as it is needed. Remediation should be a comprehensive program that focuses on the development of understanding and approaches old material in a variety of new ways. Remediation should not be confused with the repetition of rote procedures that were not understood previously.

APPROPRIATE USE OF CALCULATORS

Educators must recognize the importance of technological advances that affect the study of mathematics. The use of calculators should be incorporated into the mathematics program. The calculator should be used to strengthen basic skills; however, it cannot replace paper/pencil proficiency in those skills. Appropriate use of the calculator will enable students to focus on concepts and problem solving. It is recommended that four-function calculators be used in the elementary grades and that scientific calculators be used in secondary mathematics courses.

INTEGRATION OF COMPUTERS IN MATHEMATICAL INSTRUCTION

The world is evolving into an ever-increasing technological society; therefore, it is imperative that all students receive instruction in the effective use of computers. Students need ample opportunities to use computers along with appropriate software, to explore mathematical concepts, to make the transition between concrete experiences and abstract mathematical ideas, to practice skills, and to participate in problem solving situations. Is is recommended that appropriate computer-assisted instruction be a part of every mathematics course at each grade level.

USE OF MANIPULATIVES IN GRADES K-12

The appropriate use of manipulatives in mathematics instruction is essential to the success of implementing the mathematics program described within the Alabama Course of Study: Mathematics. Manipulatives may be used effectively at all grade levels to introduce concepts and to provide concrete examples of ideas and concepts already studied. Children are not abstract thinkers; hence, manipulatives should be used extensively in the elementary grades. Manipulatives help all students in kindergarten through grade twelve to make connections between concrete experiences and mathematical representations.

CONCEPT DEVELOPMENT VERSUS DRILL AND AND PRACTICE

Learning is a construction process with general understanding emerging from experience. Consequently, in mathematics instruction, concept development is an integral part of the curriculum, just as drill and practice are important components of some kinds of learning. In the Alabama Course of Study: Mathematics emphasis is placed on initial awareness, understanding, and concept development; hence, it is important that students "become aware of ..." or "demonstrate an understanding of ..." In this phase, the focus of instruction should be on concrete and pictorial representations. Drill and practice are viewed as meaningful and consequently effective, once students have an understanding of what they are doing. At this stage, students practice in a variety of situations, increase their proficiency and speed, and obtain the mathematical power needed to study new material.

COOPERATIVE LEARNING

A revived interest in cooperative learning groups has provided a way for teachers to address the need for students to apply mathematical concepts through interaction with materials, to communicate their thoughts about mathematical concepts, and to explore alternative approaches to problem solving. Working in small groups allows students to highlight their strengths, to build more positive attitudes toward mathematics, to increase confidence, and to improve performance.

ALABAMA COURSE OF STUDY

MATHEMATICS

PROGRAM OUTLINES

K-12*

*Outcomes for grades K-6 are organized under topics within individual areas.

Outcomes for courses in grades 7-12 are organized according to instructional objectives within individual areas.

KINDERGARTEN

Kindergarten mathematics focuses on providing opportunities for students to establish a foundation for mathematical thinking and understanding. The best school environment for establishing this foundation is a classroom where students are active and alert, and where they have opportunities to put all types of objects, events, and actions into various relationships.

Young children's construction of mathematical understanding is linked directly to their developmental readiness. Consequently, indirect teaching through organized play, discovery times, and everyday classroom experiences are as important to the kindergarten curriculum as structured learning activities. Kindergarten classrooms should provide the following:

- Access to a variety of activities and materials,
- Opportunities for interaction with classmates, and
- Time to explore, experiment with, investigate, and propose solutions to classroom situations.

Student outcomes in kindergarten are not intended to be rigid, mastery requirements. Instead, they are viewed as the results of developmentally-appropriate, direct, and indirect teaching. While the outcomes are considered appropriate to the grade level in general, adjustments may need to be made for individual students. It is important, therefore, for teachers to be familiar with prescribed content in adjacent grade levels.

MATHEMATICS
KINDERGARTEN

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
NUMBER CONCEPTS	1. Become aware of language associated with mathematics. - Number words - Comparison words Examples: as many as, the same number as, more than, less than, the most - Ordinal numbers - Positional and temporal terms Examples: first, last, next
	2. Arrange objects in various patterns.
	3. Sort, compare, classify, and order objects events, and actions.
	4. Recite number words in correct sequence.
	5. Make and compare sets of objects.
	6. Explore one-to-one correspondence through a variety of activities.
	7. Associate numerals with numbers (0-10).
	8. Match or associate number words with sets of objects (ten or fewer members).
	9. Use number words and numerals in everyday classroom situations.
	10. Quantify objects, events, and actions in everyday classroom situations. Examples: divide snacks and materials equitably among classmates; keep records of persons present and absent
OPERATIONS ON WHOLE NUMBERS	11. Develop an awareness of addition and subtraction. - Tell number stories - Act out number stories - Join and separate sets of objects - Respond orally to problems presented in number stories
FRACTIONS	12. Become aware that a whole object may be divided into parts.

MATHEMATICS
KINDERGARTEN

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	13. Investigate and compare the length, height, and width of various objects.
	14. Investigate the capacity of different containers.
	15. Become aware of and use measurement terms. Examples: longer than, shorter than, taller than, wider than, more than, less than, same as
	16. Become aware of and use terms needed to describe events that occur over a period of time. Examples: before, after, first, last
	17. Become aware of variations in temperature. Examples: hot, cold, warm, cool
NONSTANDARD MEASUREMENT	18. Measure a dimension of an object using a nonstandard unit.
	19. Estimate how many of a nonstandard unit will be required to measure a dimension of an object.
	20. Compare duration of classroom activities using nonstandard measures. Examples: hourglass, egg timer
STANDARD MEASUREMENT	21. Relate daily events to time on a clock and/or time on a calendar.
	22. Become aware of units used to measure time. Examples: minutes, hours, days, weeks, months, seasons of the year, years

MATHEMATICS
KINDERGARTEN

AREA: **MEASUREMENT**

TOPICS	STUDENT OUTCOMES
	Students will
STANDARD MEASUREMENT (continued)	23. Sort coins according to various attributes. 24. Act out stories involving the exchange of money for items.

MATHEMATICS
KINDERGARTEN

AREA: GEOMETRY

TOPICS | STUDENT OUTCOMES

Students will

GEOMETRIC CONCEPTS

25. Become aware of likenesses and differences of geometric shapes.
    - Between plane figures
    - Between plane and solid figures
    - Between solid figures
26. Use positional terms.

    Examples: beside, inside, outside, above, below, between, on
27. Relate vocabulary of geometric shapes (circle, triangle, square, rectangle) to geometric materials.
28. Identify geometric shapes in objects from the environment.
29. Become aware of attributes of objects.

    Examples: round, flat, curved, straight
30. Relate geometry to art.

    Examples: cut-out shapes, free-style drawings, concrete objects from the environment

MATHEMATICS
KINDERGARTEN

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	31. Discover through numerous activities involving the creation and comparison of sets that the quantity remains the same when the spatial arrangements of the objects change.

MATHEMATICS
KINDERGARTEN

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
AWARENESS OF PATTERNS	32. Reproduce and extend rhythmic patterns.
	33. Reproduce and extend patterns of objects.
	34. Become aware of patterns in the environment.
	35. Create patterns. Examples: rhythms, objects, pictures

MATHEMATICS
KINDERGARTEN

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
SORTING	36. Sort and resort a given collection of objects by various attributes.
LANGUAGE	37. Become aware of the quantifiers "all", "none", "every."

MATHEMATICS
KINDERGARTEN

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
COLLECTION, ORGANIZATION, AND INTERPRETATION OF INFORMATION	38. Gather and organize information from the immediate environment. Examples: transportation to school, pets owned by students, articles of clothing worn by students
	40. Participate in graphing activities with concrete objects.
	41. Interpret graphs in terms of more, less, same. - Graphs using real objects - Pictographs

FIRST GRADE

The first-grade mathematics program is a natural progression from the foundation established in kindergarten. Program goals and activities in these two grades overlap because of the similarity of developmental characteristics of five-, six-, and seven-year-old children.

The primary purpose of first-grade mathematics is to provide children with the time to construct mathematical understandings for themselves. Consequently, indirect teaching through organized play, discovery times, and everyday classroom experiences are as important to the first-grade curriculum as structured learning activities. First-grade classrooms should provide the following:

- Access to a variety of activities and materials,
- Opportunities for interaction with classmates, and
- Time to explore, experiment with, investigate, and propose solutions to classroom situations.

Student outcomes in first grade are not intended to be rigid, mastery requirements. Instead, they are viewed as the results of developmentally-appropriate, direct, and indirect teaching. While the outcomes are considered appropriate to the grade level in general, adjustments may need to be made for individual students. It is important, therefore, for teachers to be familiar with prescribed content in adjacent grade levels.

MATHEMATICS
FIRST GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
NUMBER CONCEPTS	1. Become aware of language associated with mathematics. - Number words - Comparison words Examples: as many as, the same number as, more than, less than, the most - Ordinal numbers - Positional and temporal terms Examples: first, last, next, up, down, left, right
	2. Arrange objects in various patterns.
	3. Sort, compare, classify, and order objects events, and actions.
	4. Recite number words in correct sequence.
	5. Make and compare sets of objects.
	6. Explore one-to-one correspondence through a variety of experiences.
	7. Count by ones, twos, fives, and tens.
	8. Use counting to solve problems.
	9. Read and write numerals (0-100).
	10. Recognize written number words for numerals (0-20).
	11. Become aware of different names for numbers.
	12. Become aware of the number line.
	13. Use number words and numerals in everyday classroom situations.
	14. Quantify objects, events, and actions in everyday classroom situations. Examples: divide snacks and materials equitably among classmates; keep records of persons present and absent

MATHEMATICS
FIRST GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
NUMBER CONCEPTS (Continued)	15. Identify the ordinal positions of objects (first through tenth).
OPERATIONS ON WHOLE NUMBERS	16. Comprehend and use language associated with joining and separating of groups of objects. - Altogether - Total - Added to - Taken from - Left - Remain
	17. Demonstrate an understanding of addition and subtraction. - Tell number stories - Act out number stories - Join and separate sets of objects - Respond orally to problems presented in number stories
	18. Relate the addition and subtraction signs (+, -) to the actions of joining and separating sets of objects.
	19. Add and subtract numbers presented in vertical and/or horizontal format, without regrouping.
	20. Use zero in addition and subtraction.
	21. Become aware that the order of the addends in addition does not change the sum.
FRACTIONS	22. Become aware that a whole object may be divided into equal parts.
	23. Develop strategies for dividing objects into equal parts.

MATHEMATICS
FIRST GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	24. Compare length, height, width, and capacity of objects using terms of comparison. Examples: taller than, wider than
	25. Compare the mass/weight of two objects and describe their relationship. - Heavier than - Lighter than
	26. Order objects according to length.
NONSTANDARD MEASUREMENT	27. Compare the duration of classroom activities using nonstandard measures. Examples: hourglass, egg timer
	28. Determine the length, mass/weight, and/or capacity of various objects. - Using nonuniform measures, such as various pencils - Using uniform measures, such as a particular pencil
	29. Estimate and verify measurements of length, mass/weight, and/or capacity of objects using nonstandard measures.
	30. Understand the need for a standard unit of measurement.

MATHEMATICS
FIRST GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
STANDARD MEASUREMENT	31. Become aware of the tools and language of measurement. - Yardstick (inches and yards) - Meterstick (centimeters and meters) - Ruler (inches and centimeters) - Thermometer (degrees) - Clock (hours, minutes, seconds)
	32. Determine the length of objects using a standard system of measurement. Examples: inches, centimeters, yards, meters
	33. Identify units of time on a calendar. - Days of the week - Months of the year
	34. Begin to tell time using digital and/or analog clocks.
	35. Sequence events according to the passage of time.
	36. Recognize coins and the dollar bill.
	37. Relate coins to their monetary values.
	38. Determine the monetary value of a set of coins.

MATHEMATICS
FIRST GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
GEOMETRIC CONCEPTS	39. Recognize likenesses and differences of geometric shapes. - Between plane figures - Between plane and solid figures - Between solid figures
	40. Use positional terms.
	41. Identify geometric shapes in objects from the environment.
	42. Identify plane geometric figures. Examples: circle, square, rectangle, triangle
	43. Relate the vocabulary of solid geometric figures to familiar objects. Examples: sphere, cylinder, cone, cube, rectangular prism
	44. Relate geometry to art. Examples: cut-out shapes, free-style drawings, concrete objects from the environment
	45. Investigate and describe attributes of plane and solid objects. Examples: round, flat, curved, straight

MATHEMATICS
FIRST GRADE

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	46. Discover through numerous activities involving the creation and comparison of sets that the quantity remains the same when the spatial arrangements of the objects change.
PROPERTIES OF NUMBERS	47. Become aware of the role of zero in addition and subtraction.
	48. Become aware of the commutative property of addition. Example: 2 + 3 = 3 + 2
	49. Explore addition and subtraction as inverse operations. Example: 2 + 3 = 5 5 - 3 = 2 5 - 2 = 3

MATHEMATICS
FIRST GRADE

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
AWARENESS OF PATTERNS	50. Reproduce and extend rhythmic patterns.
	51. Reproduce and extend patterns involving objects.
	52. Identify and describe patterns in the environment.
	53. Create patterns. Examples: rhythms, objects, pictures, shapes
	54. Become aware of number patterns. Examples: calendar, number chart, number line

MATHEMATICS
FIRST GRADE

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
SORTING	55. Sort and resort a given collection of objects by various attributes.
LANGUAGE	56. Use accurately the quantifiers "all," "none," and "every."

MATHEMATICS
FIRST GRADE

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
COLLECTION, ORGANIZATION, AND INTERPRETATION OF INFORMATION	57. Gather and organize information from the immediate environment. Examples: transportation to school, pets owned by students, articles of clothing worn by students
	58. Record information using concrete representations and pictographs.
	59. Interpret graphed information in terms of more, less, the same.
	60. Tally information. Examples: games, classroom activites
CHANCE EVENTS	61. Become aware of real-life situations which involve the likelihood of events happening.
	62. Predict and record outcomes of events.

SECOND GRADE

The second-grade mathematics program is an extension of concepts introduced in kindergarten and first grade. The skills of addition and subtraction with whole numbers are practiced and applied in a variety of situations.

In second grade, many new concepts and skills are introduced and explored. Development of skills should be enhanced through the use of varied instructional strategies and manipulative and pictorial experiences. Students should be given further opportunities to interact with classmates and the time to explore, experiment with, investigate, and propose solutions to classroom situations.

Student outcomes in second grade are not intended to be rigid mastery requirements. Instead, they are viewed as the results of developmentally-appropriate, direct, and indirect teaching. While the outcomes are considered appropriate to the grade level in general, adjustments may need to be made for individual students. It is important, therefore, for teachers to be familiar with prescribed content in adjacent grade levels.

MATHEMATICS
SECOND GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
NUMBER CONCEPTS	1. Comprehend and use terms associated with mathematics. - Number words - Ordinal numbers (first through twentieth) - Comparison words Examples: less than, greater than, equal to 2. Count by ones, twos, fives, and tens. 3. Relate signs to comparison terms. - Less than (<) - Greater than (>) - Equal to (=) 4. Read, write, compare, and/or order whole numbers (0-1000). 5. Recognize written number words for the numerals (0-100). 6. Recognize odd and even numbers. 7. Recognize different names for numbers. 8. Comprehend and use number words and numerals in everyday classroom situations. 9. Become aware of place value. - Regrouping ones to tens and ones - Regrouping tens to hundreds and tens - Associating groupings of hundreds, tens, and ones with numerals - Recognizing zero as a place holder 10. Use the number line. Examples: addition, subtraction, ordering, multiplication, problem solving

MATHEMATICS
SECOND GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
OPERATIONS ON WHOLE NUMBERS	11. Develop proficiency in adding and subtracting without regrouping.
	12. Add and subtract numbers presented in vertical and/or horizontal format with and without regrouping.
	13. Use the inverse relationship of addition and subtraction. Examples: in developing fact families, in checking work, in solving number stories
	14. Apply the commutative property of addition when adding numerals. Examples: 2 + 3 = 3 + 2
	15. Understand the use of zero in addition and subtraction.
	16. Become aware of the use of the associative property of addition. Example: (2 + 3) + 4 = 2 + (3 + 4)
	17. Solve simple story problems involving addition and subtraction.
	18. Become aware of multiplication. - Recognize groups of equal number in the environment - Express multiplication as repeated addition - Solve orally and act out number stories - Learn the mathematical language associated with multiplication - Use the multiplication sign (x) - Build models of multiplication facts - Use one as multiplier
	19. Multiply single-digit numbers.

MATHEMATICS
SECOND GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
OPERATIONS ON WHOLE NUMBERS (continued)	20. Become aware that the order of the factors does not affect the product.
	21. Become aware of division. - Tell number stories - Respond orally to and act out number stories - Use repeated subtraction
FRACTIONS	22. Identify fractional parts of a whole.
	23. Find fractional parts of a set of objects. Examples: halves, thirds, fourths
	24. Demonstrate an understanding of fractions. - Respond orally to number stories - Tell number stories - Act out number stories
	25. Develop the ability to read and write fractions.

MATHEMATICS
SECOND GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	26. Use terms of comparison to describe measurements of length, height, width, weight, and capacity.
	27. Relate classroom events to clock time. - Sequence events of the day using clock time - Determine duration of classroom activities
STANDARD MEASUREMENT	28. Recognize sequence of time on a calendar. Examples: Tuesday just before Wednesday, yesterday, today, tomorrow
	29. Tell time using a digital and/or analog clocks.
	30. Determine length/distance using metric units. - Meter - Centimeter
	31. Recognize abbreviations for metric linear units of measure. - Meter (m) - Centimeter (cm)
	32. Estimate measurements of an object in metric linear units.
	33. Weigh objects to determine mass in grams and kilograms.
	34. Measure liquids to determine capacity in liters.
	35. Read a Celsius thermometer to determine temperatures.

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
STANDARD MEASUREMENT (continued)	36. Determine length/distance, mass/weight, and capacity using appropriate customary units of measurement. Examples: Capacity: cups, as they are used in recipes Mass/weight: pounds, as they are used to weigh students
	37. Identify the monetary values of coins and the dollar bill.
	38. Identify and use monetary signs. - Dollar ($) - Cents (¢) - Decimal point (.)
	39. Compare the value of sets of coins.
	40. Determine the perimeter of plane figures.
APPLICATIONS	41. Select and use appropriate measurement tools for solving measurement problems.
	42. Make change to $1.00.
	43. Solve problems involving money.

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
GEOMETRIC CONCEPTS	44. Comprehend and use terms associated with plane and solid figures. Examples: side, edge, surface, point, line, square, rectangle, circle, triangle, line segment, cone, cube, cylinder
	45. Compare attributes of plane and solid objects. - Size - Shape
	46. Relate geometry to art. Examples: cut-out shapes, free-style drawings, concrete objects from the environment
CONGRUENCE, SIMILARITY, SYMMETRY	47. Recognize geometric symmetry. Examples: folded paper, mirror images, leaves
	48. Recognize congruent shapes and figures.
PERIMETER AND AREA	49. Distinguish between the perimeter and the area of familiar objects.

MATHEMATICS
SECOND GRADE

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	50. Solve simple number sentences. - Concretely - Pictorially - Abstractly
PROPERTIES OF NUMBERS	51. Understand the inverse relationship of addition and subtraction.
	52. Understand the commutative relationship of addition.
	53. Become aware of the associative property for addition.
	54. Recognize that subtraction is not commutative. Example: 10 - 2 is not equivalent to 2 - 10
	55. Recognize the identity elements for addition and multiplication. Examples: 0 + 5 = 5 1 x 3 = 3
	56. Become aware of the commutative property for multiplication.

MATHEMATICS
SECOND GRADE

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
CONCEPTS OF PATTERN	57. Extend patterns composed of symbols or objects.
	58. Identify patterns in a sequence of objects and/or symbols and make predictions.
	59. Create designs that change in an orderly, predictable manner.
AWARENESS OF FUNCTIONS	60. Recognize patterns for sums and differences.
	61. Recognize patterns in number charts or on the number line that represent relationships between the numbers.

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
SORTING	62. Sort a given collection of objects by the presence or absence of two or more attributes.
LANGUAGE	63. Use accurately the quantifiers "all," "every," "none," and "some."

MATHEMATICS
SECOND GRADE

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
COLLECTION, ORGANIZATION, AND INTERPRETATION OF INFORMATION	64. Collect and organize information. - Lists - Pictographs - Bar graphs
	65. Interpret information in terms of more, less, same, most, least.
	66. Tally and interpret information. Examples: games, classroom activities
CHANCE EVENTS	67. Discuss and use the language of chance. Examples: one chance in two, one chance in three
	68. Predict and record outcomes. Examples: coin tossing, number cubes
	69. Become aware that some results are predictable and others are not.

THIRD GRADE

The third-grade mathematics program is based on a firm foundation of previous experiences in mathematics. Students at this age should develop proficiency in addition and subtraction of whole numbers and learn to use calculators as tools to solve problems involving large numbers.

Problem-solving abilities are strengthened as students apply problem-solving techniques to all areas of the mathematics curriculum. Students are introduced to rounding numbers as another way to estimate. Measurement skills are expanded as students determine elapsed time. In the area of patterns and functions, simple concepts associated with the coordinate plane are developed. Reasoning skills are applied as students become involved in collecting, organizing, and interpreting data.

The instructional program in third-grade mathematics should consist of activities that help students extend their mathematical thinking and understanding. Manipulatives should be an important avenue through which students can gain insights into mathematical concepts and skills.

MATHEMATICS
THIRD GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
NUMERATION AND PLACE VALUE	1. Read, write, compare, and order whole numbers.
	2. Recognize written number words representing numerals (0-1000).
	3. Use signs (>, <, and =) to represent the relationships of greater than, less than, and equal to.
	4. Use ordinal numbers to compare and order quantities.
	5. Count by multiples.
	6. Distinguish between and use odd and even numbers.
	7. Understand and use place value. - Regroup ones to tens and ones - Regroup tens to hundreds and tens - Regroup hundreds to thousands and hundreds - Associate groupings of thousands, hundreds, tens, and ones with numerals - Identify the place value of any digit in a numeral - Recognize zero as a place holder
	8. Use the number line. Examples: multiplication, fractions, problem solving
ROUNDING AND ESTIMATING	9. Round whole numbers to the nearest ten and/or hundred.
	10. Estimate answers to problems involving addition, subtraction, multiplication, and division.
OPERATIONS ON WHOLE NUMBERS	11. Use signs associated with the basic operations.
	12. Apply the commutative and associative properties of addition and multiplication when adding and multiplying.

MATHEMATICS
THIRD GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
OPERATIONS ON WHOLE NUMBERS (continued)	13. Use the inverse relationship of addition and subtraction.

13. Use the inverse relationship of addition and subtraction.

14. Develop proficiency in adding and subtracting whole numbers.

15. Locate calculation errors involving addition and subtraction.

16. Use a calculator to solve problems.

17. Demonstrate an understanding of multiplication.

    - Make representations of number stories involving multiplication
    - Build models of multiplication problems

18. Use the identity element for multiplication.

19. Recognize the use of zero in multiplication.

20. Develop proficiency in multiplying single-digit numbers.

21. Multiply whole numbers with and without regrouping.

    - Multiplicands up to three digits
    - Single-digit multipliers

22. Develop an understanding of division.

    - Tell number stories
    - Respond orally to and act out number stories
    - Illustrate division as repeated subtraction
    - Illustrate division as the inverse of multiplication

23. Divide dividends by one-digit divisors.

24. Interpret and find solutions to word problems involving the four basic operations.

MATHEMATICS
THIRD GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
FRACTIONS	25. Recognize equivalent fractions.
	26. Read and write fractions.
	27. Identify fractional parts. - Whole objects - Sets of objects
	28. Compare and order fractions. - Like denominators - Unit fractions
	29. Solve simple word problems involving fractions.
DECIMALS	30. Recognize and use the decimal point in its relationship to money values.
	31. Add and subtract money values.

MATHEMATICS
THIRD GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	32. Use terms of comparison to describe measurements of length, height, width, weight, and capacity.
STANDARD MEASUREMENT	33. Become aware of elapsed time using calendars.
	34. Explain vocabulary associated with time. - a.m. - p.m. - Noon - Midnight
	35. Tell and record time. - Digital - Analog
	36. Determine length/distance, mass/weight, and capacity using metric measuring tools.
	37. Recognize and use abbreviations of both metric and customary units of measure.
	38. Determine length/distance, mass/weight, and capacity using customary measuring tools. - Length (inch, foot, yard, mile) - Capacity (pint, quart, gallon) - Weight (pound)
	39. Estimate measurements and verify their accuracy. - Metric - Customary
	40. Identify equivalent measures within a measurement system.
	41. Read both Celsius and Fahrenheit thermometers.
	42. Use dollar, cent, and decimal notations.
	43. Determine the perimeter of polygons.

MATHEMATICS
THIRD GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
APPLICATIONS	44. Determine elapsed time. Examples: 1:00 p.m. until 3:00 p.m., 10:30 a.m. until 1:00 p.m.
	45. Select and use appropriate measurement tools to solve measurement problems.
	46. Identify coins and currency (to five dollars) and make change (to one dollar).
	47. Use a variety of methods to solve problems involving money. - Mental arithmetic - Paper and pencil - Estimation - Calculator

MATHEMATICS
THIRD GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
GEOMETRIC CONCEPTS	48. Comprehend and use terms associated with plane and solid figures. - Side - Edge - Surface - Point - Line - Line segment - Ray - Vertex - Angle
	49. Recognize and name a variety of plane and solid geometric figures from models, pictures, and drawings. Examples: quadrilaterals, pentagons, hexagons, octagons, cones, cubes, cylinders, spheres
	50. Recognize angles. Examples: right, acute, obtuse
CONGRUENCE, SIMILARITY, SYMMETRY	51. Identify lines of symmetry. Examples: drawings, paper cuts, computer graphics
	52. Draw lines of symmetry.
	53. Recognize congruent shapes and figures.
	54. Use problem-solving techniques to understand geometric concepts. - Congruence - Symmetry

MATHEMATICS
THIRD GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
PERIMETER AND AREA	55. Use problem-solving techniques to understand geometric concepts. - Perimeter - Area 56. Distinguish between the perimeter and the area of familiar objects.

MATHEMATICS
THIRD GRADE

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	57. Recognize and use addition and subtraction number sentences to express equalities.
	58. Write and solve addition number sentences with a missing addend.
	59. Write and solve subtraction number sentences with a missing subtrahend.
PROPERTIES OF NUMBER	60. Recognize the commutative and associative properties of addition and multiplication.
	61. Recognize that addition and subtraction are inverse operations.
	62. Recognize the identity properties of addition and multiplication.
	63. Recognize multiplication and division as inverse operations.

MATHEMATICS
THIRD GRADE

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
PATTERN CONCEPTS	64. Create designs that change in an orderly, predictable manner.
	65. Predict additional terms in a given pattern and describe verbally how the pattern was created.
	66. Extend patterns in number lines and tables that represent number relations.
	67. Use patterning as a problem-solving strategy.
	68. Use a calculator to explore patterns in sets of whole numbers.
FUNCTION CONCEPTS	69. Locate points on a grid.
	70. Follow directions for moving from place to place on a grid. - Horizontal path - Vertical path - Horizontal and vertical paths

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
SORTING	71. Sort a given collection of objects by the presence or absence of two or more attributes.
LANGUAGE	72. Use accurately the quantifiers "all", "none," "every", and "some."
REASONING	73. Determine the operation needed to solve word problems.

MATHEMATICS
THIRD GRADE

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
COLLECTION, ORGANIZATION, AND INTERPRETATION OF INFORMATION	74. Collect and organize information. - Lists - Pictographs - Bar graphs - Tables - Circle graphs
	75. Interpret data in terms of more, less, the same, most, least.
	76. Become aware of sampling as a technique to make predictions.
	77. Tally and interpret information.
CHANCE EVENTS	78. Make predictions about events whose outcomes can be verified. Examples: weather, events in the school day, items served in the school cafeteria
	79. Develop story problems which involve chance happening.
	80. Predict and record outcomes.

FOURTH GRADE

The fourth-grade mathematics program should focus on providing many opportunities for students to extend their knowledge base and to develop further their problem-solving abilities in mathematics. Students at this grade level are beginning to make the transition from learning what mathematics is to learning how to use mathematics.

In the area of number, students should demonstrate proficiency in addition and subtraction of whole numbers. Although students should already know basic multiplication and division facts, they should use them to develop proficiency in multiplication and division of whole numbers using one- and two-digit multipliers and divisors. Calculators should be used to perform computation problems involving large numbers and as tools in problem-solving situations. Concepts associated with fractions and decimals should be expanded to include computation.

Students should be involved with activities that develop proficiency in measuring and solving problems in measurement and that expand their knowledge of geometric concepts including congruence, similarity, symmetry, perimeter, and area. They should also construct, classify, and solve number sentences in algebra; determine patterns and functions and plot points on a grid; develop reasoning abilities in logic; and collect, organize, and interpret information in statistics and probability.

While students at this grade level can handle more abstract mathematical concepts, their first encounters with such concepts should involve experiences with concrete materials. Students are more likely to understand mathematical concepts when instruction proceeds from the concrete level to the pictorial level and finally to the abstract level.

MATHEMATICS
FOURTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
NUMERATION AND PLACE VALUE	1. Identify the place value of any digit in a numeral.
	2. Read, write, compare, and order whole numbers.
	3. Use the signs >, <, =, and ≠ when comparing numbers or numerical expressions.
	4. Demonstrate an understanding of expanded notation. - State a number when given a quantity of groups of ones, tens, hundreds, and thousands. - Write a number in expanded form. Examples: 342 = 3 hundreds + 4 tens + 2 ones 342 = (3 x 100) + (4 x 10) + (2 x 1)
ROUNDING AND ESTIMATING	5. Round whole numbers to the nearest ten, hundred, and/or thousand.
	6. Round decimals to the nearest whole number.
	7. Round money values to the nearest dollar and/or nearest dime.
	8. Estimate sums and differences. - Whole numbers - Decimal numbers - Money values
	9. Estimate products and quotients of whole numbers.
FACTORS AND MULTIPLES	10. Understand and use terminology associated with factors and multiples of whole numbers. - Factors - Multiples - Perfect squares - Greatest common factor - Prime numbers - Composite numbers - Least common multiple

MATHEMATICS
FOURTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
FACTORS AND MULTIPLES (continued)	11. Determine the factors of whole numbers.
	12. Identify the greatest common factor between two numbers.
	13. Identify prime and composite numbers.
	14. Find the least common multiple between two numbers.
	15. Become aware of divisibility rules.
ADDITION AND SUBTRACTION OF WHOLE NUMBERS	16. Demonstrate proficiency and speed in addition and subtraction of whole numbers.
	17. Solve addition and subtraction word problems.
	18. Use addition and/or subtraction in problem-solving situations.
	19. Determine and use the most appropriate method of calculation. - Paper/pencil - Mental arithmetic - Calculator
MULTIPLICATION AND DIVISION CONCEPTS	20. Apply the commutative and associative properties to simplify and solve multiplication problems.
	21. Demonstrate division as the inverse of multiplication.
MULTIPLICATION AND DIVISION OF WHOLE NUMBERS	22. Perform one-digit multiplication and division with speed and proficiency.
	23. Multiply and divide with one- and two-digit multipliers and divisors.

MATHEMATICS
FOURTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
MULTIPLICATION AND DIVISION OF WHOLE NUMBERS (continued)	24. Multiply or divide larger numbers using a calculator or computer.
	25. Determine the most appropriate method of calculation. - Paper/pencil - Mental arithmetic - Calculator
	26. Solve simple multiplication or division word problems.
CONCEPTS OF FRACTIONS	27. Identify proper fractions, improper fractions, and mixed numbers.
	28. Recognize fractions as a form of division.
EQUIVALENT FRACTIONS	29. Identify the fractional equivalents of a whole number.
	30. Change improper fractions to whole or mixed numbers and vice versa.
	31. Identify and find equivalent fractions.
	32. Simplify fractions.
	33. Find least common denominators.
	34. Compare and order like and unlike fractions.

MATHEMATICS
FOURTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
ADDITION AND SUBTRACTION OF FRACTIONS	35. Add and subtract fractions with like denominators.
	36. Solve simple addition and subtraction problems with fractions using mental arithmetic.
	37. Solve simple addition and subtraction word problems involving fractions.
CONCEPTS OF DECIMALS AND MONEY VALUES	38. Read, write, and interpret decimals through the hundredths' place.
	39. Write money amounts in words and dollar and cents notation.
	40. Compare and order decimal numbers and amounts of money.
OPERATIONS ON DECIMAL NUMBERS AND MONEY VALUES	41. Find sums and differences of amounts of money or decimal numbers.
	42. Multiply and divide an amount of money by a one-digit number.

MATHEMATICS
FOURTH GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	43. Compare and order measurements of two or more objects using terms of comparison. - Length - Mass/weight - Capacity/volume
	44. Demonstrate measurement skills in a variety of situations. Examples: space needed for furniture, size of container needed for an item
STANDARD MEASUREMENT	45. Identify time of day to the nearest one-minute interval using both digital and analog clocks.
	46. Relate equivalent units of time. Examples: 52 weeks = 1 year 10 years = 1 decade 60 minutes = 1 hour
	47. Identify and relate abbreviations and/or symbols to their corresponding units of measure.
	48. Determine length/distance, mass/weight, and capacity using metric and customary tools.
	49. Estimate length, weight, capacity, and temperature in a given situation and verify the accuracy of the estimate.

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
STANDARD MEASUREMENT (continued)	50. Determine the perimeter of figures using a ruler, string, or any other standard or nonstandard device.
	51. Estimate area of geometric figures. - Grid paper - Unit squares
	52. Identify equivalent measures within a system of measure. - Metric - Customary
APPLICATIONS	53. Perform addition and subtraction with units of measurement with one regrouping. - Length - Capacity - Mass/weight - Time - Temperature
	54. Determine and count back change.
	55. Solve problems requiring a knowledge of the value of coins or amounts of money.
	56. Solve problems related to calendars and/or clocks.
	57. Determine elapsed time.
	58. Select and use appropriate tools for solving measurement problems.
	59. Make simple scale drawings using grid paper.
	60. Determine distances on a map using the provided scale of distance and a straightedge.

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
GEOMETRICAL FIGURES	61. Identify and describe physical representations of geometric shapes. Examples: soft drink can, ice cream cone, marble, brick
	62. Identify, define, or draw geometric representations. - Points - Lines - Line segments - Perpendicular lines - Parallel lines - Right triangles - Rays - Angles
	63. Identify and describe attributes and properties of simple plane and solid geometric figures.
	64. Draw geometric representations of figures using a straightedge. - Plane figures - Solid figures
	65. Draw diagonals in plane geometric figures.
CONGRUENCE, SIMILARITY, AND SYMMETRY	66. Determine lines of symmetry.
	67. Identify congruent figures and congruent parts of geometric figures.
	68. Identify and use geometric transformations. - Flips - Turns - Slides
	69. Draw a line segment congruent to a given line segment.

MATHEMATICS
FOURTH GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
COMBINING AND PARTITIONING GEOMETRIC SHAPES	70. Determine the possible geometric figures that can combine to make a given shape.
	71. Partition geometric shapes into their basic geometric figures.
PERIMETER AND AREA	72. Use models to develop and apply the formula to the area of a rectangular region.
	73. Use models and measurement to determine perimeter of figures.

MATHEMATICS
FOURTH GRADE

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	74. Recognize and identify true, false, and open number sentences as they are used to express numerical relationships. 75. Construct number sentences. 76. Solve number sentences involving addition, subtraction, and/or multiplication.
EQUALITY RELATIONSHIPS	77. Know that two equivalent quantities remain equal when the same change takes place on each quantity. - Concrete objects - Pictures - Numbers - Symbols 78. Associate a numeral, a word, or a numerical expression with equivalent expressions.
PROPERTIES OF OPERATIONS	79. Recognize number sentences that serve as examples of properties of operations on numbers. - Identity elements for addition and multiplication - Commutative property of addition and multiplication - Associative property of addition and multiplication - Distributive property of multiplication over addition - Inverse relationship between addition and subtraction and between multiplication and division 80. Develop an understanding of the order of operations. - Addition - Subtraction - Multiplication - Role of parentheses

MATHEMATICS
FOURTH GRADE

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
CONCEPTS OF PATTERNS AND FUNCTIONS	81. Discover patterns by examining number sequences.
	82. Generate a pattern from a given rule.
	83. Identify a rule used to generate a pattern.
	84. Extend number sequences by following an established pattern.
	85. Devise and explain different ways patterns may be extended.
	86. Construct patterns using numbers and/or geometric figures.
	87. Recognize similar patterns.
	88. Determine a pattern and/or a function. Examples: act out a situation, draw a diagram, construct and read a graph, record and read information in simple tables
	89. Identify and plot points on a grid.

MATHEMATICS
FOURTH GRADE

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
LANGUAGE	90. Use accurately the vocabulary of logic in speaking and writing. - All - Some - None - Or - And - Every
REASONING	91. Formulate statements that reflect accurate conclusions about objects or situations.
	92. Determine whether conditional statements are true or false.
	93. Verbalize the steps involved in determining a valid conclusion for a set of premises.

MATHEMATICS
FOURTH GRADE

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
STATISTICAL INFORMATION	94. Follow a logical process to collect, organize, and interpret information using calculators and computers where possible. - List questions to be answered about a topic before and after information is gathered - Predict outcomes - Record data - Analyze and interpret data based on predetermined questions - Organize and display data on charts, diagrams, tables, and graphs
	95. Collect information or conduct a survey using sampling techniques.
	96. Find the mean of a set of data.
PROBABILITY OF EVENTS	97. Determine number of possible outcomes of independent events. Examples: coin toss, selection of an item
	98. Record data and observe results in probability experiments. Examples: coin toss, spinner, selection of an item

FIFTH GRADE

The emphases in the fifth-grade mathematics program are problem solving; the maintenance and application of concepts and skills learned previously; and the development of additional concepts and skills associated with whole numbers, decimals, fractions, and integers. It is imperative that computational skills be developed to a specified level of proficiency and that they be applied while exploring, experimenting, and solving realistic problems.

Students should apply measurement concepts while seeking solutions to problems. Knowledge of geometric figures and concepts should be extended to include construction of figures and application of formulas for calculating perimeter and area of rectangular figures. The concepts of variable and order of operation should be developed as well. Students determine patterns and functions using different problem-solving techniques. Examining conditional statements, formulating accurate conclusions, and developing an awareness of vocabulary associated with sets are included in the area of logic. In the area of statistics and probability, data should be organized and displayed in a variety of ways and predictions made about the outcome of events.

Fifth-grade students are more capable of dealing with abstract concepts than are younger children. However, effective instructional strategies should incorporate appropriate manipulatives and pictorial representations so that abstract symbols will have greater meaning for students, especially when new concepts and skills are introduced.

MATHEMATICS
FIFTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
PLACE VALUE OF WHOLE AND DECIMAL NUMBERS	1. Read, write, and compare whole numbers.
	2. Identify the place value of any digit in numerals.
	3. Use expanded notation to write and interpret whole numbers through millions.
	4. Read, write, interpret, compare, and order decimals through the thousandths' place.
	5. Read, write, interpret, compare, and order decimals greater than one.
	6. Write decimals for fractions and mixed numbers.
ROUNDING AND ESTIMATING	7. Round whole numbers.
	8. Round decimals to the nearest whole number.
	9. Estimate sums, differences, products, and quotients of whole numbers.
	10. Estimate sums, differences, and products of decimals.
ROMAN NUMERALS	11. Read, write, and interpret Roman numerals.
FACTORS AND MULTIPLES	12. Factor whole numbers.
	13. Extract the prime factors of whole numbers.
	14. Identify numbers that are perfect squares or cubes.
	15. List multiples of whole numbers using calculators when possible.
	16. Find least common multiple/least common denominator.
	17. Find greatest common factor.
	18. Use divisibility rules.

MATHEMATICS
FIFTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
OPERATIONS ON WHOLE AND DECIMAL NUMBERS	19. Demonstrate proficiency in addition and subtraction. - Whole numbers - Decimal numbers - Money values
	20. Apply the commutative and associative properties to simplify and solve multiplication problems.
	21. Multiply and divide with two-digit multipliers and divisors.
	22. Multiply two decimal numbers.
	23. Multiply a money value by a whole number.
	24. Divide a decimal number or an amount of money by a whole number.
	25. Solve word problems involving whole numbers, decimals, or money values.
	26. Use basic operations in problem-solving situations.
	27. Determine and use the most appropriate method of calculation. - Paper/pencil - Mental arithmetic - Calculator

MATHEMATICS
FIFTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
FRACTIONS	28. Demonstrate an understanding of proper fractions, improper fractions, and mixed numbers.
	29. Use fractions as a form of division.
	30. Change improper fractions to mixed numbers and vice versa.
	31. Identify and find equivalent fractions.
	32. Find least common denominators.
	33. Compare and order fractions.
	34. Simplify fractions.
	35. Identify fractional parts of a number.
OPERATIONS ON FRACTIONS	36. Add and subtract fractions and mixed numbers.
	37. Multiply fractions. - Proper fractions - Whole number by a proper fraction - Whole number by a mixed number - Mixed numbers
	38. Demonstrate division of fractions concretely.
	39. Solve simple problems involving fractions using mental arithmetic.
	40. Solve word problems involving fractions.
INTEGERS	41. Locate integers on a number line.
	42. Add two positive or two negative integers on a number line.

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	43. Compare and order two or more angles based on size. 44. Demonstrate measurement skills in a variety of situations. Examples: space needed for furniture, size of container needed for an item
STANDARD MEASUREMENT	45. Relate the historical development of measurement to standard units in the customary and metric systems of measurement. - Nonstandard units - Customary system - Metric system - Measuring tools 46. Identify and locate major time zones in the United States. 47. Denote units of measure by their abbreviations and/or symbols. 48. Select and use appropriate measuring tools. - Linear - Mass - Capacity 49. Demonstrate proficiency in measurement. 50. Select and use appropriate customary and metric units of measurement. - Linear - Capacity - Mass/weight - Temperature - Area

MATHEMATICS
FIFTH GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
STANDARD MEASUREMENT (continued)	51. Determine the circumference of a circle by direct measurement.
	52. Measure angles using a protractor.
	53. Identify equivalent measures within a system.
	54. Determine equivalent measurements based on conversions within a system.
APPLICATIONS	55. Perform basic operations on measurements with regrouping. - Computation - Problem-solving situations
	56. Determine and count back change in currency and coins.
	57. Estimate length, weight, capacity, and temperature in given situations; and verify the accuracy of the estimates.
	58. Estimate and measure the perimeter and area of geometric shapes.
	59. Determine elapsed time.
	60. Use units of time and their equivalents to solve problems related to calendars and/or clocks.
	61. Make simple scale drawings using grid paper.

MATHEMATICS
FIFTH GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
GEOMETRIC FIGURES	62. Identify and describe physical representations of geometric shapes. Examples: soft drink can, ice cream cone, brick
	63. Make basic three-dimensional figures from two-dimensional figures and vice versa.
	64. Recognize spatial relationships in drawings of three-dimensional figures.
	65. Define and draw geometric representations, using computers when appropriate. - Points - Line segments - Perpendicular lines - Parallel lines - Lines - Rays - Angles
	66. Describe attributes and properties of plane and solid geometric figures.
	67. Identify and name component features of plane and solid geometric figures. Examples: vertices and edges
	68. Draw angles using a protractor.
	69. Construct plane geometric figures using a straightedge and a compass.
	70. Draw and label parts of a circle.
	71. Identify and draw triangles. - Right - Equilateral - Isosceles
	72. Identify right, acute, and obtuse angles.

MATHEMATICS
FIFTH GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
CONGRUENCE, SIMILARITY, AND SYMMETRY	73. Determine points of symmetry.
	74. Identify congruent figures and congruent parts of geometric figures.
	75. Identify and use geometric transformations. - Flips - Turns - Slides
	76. Construct a line segment congruent to a given line segment.
	77. Bisect line segments using a compass.
COMBINING AND PARTITIONING GEOMETRIC SHAPES	78. Determine the possible geometric figures that can combine to make a given shape.
	79. Partition geometric shapes into their basic geometric figures.
PERIMETER, AREA, AND VOLUME	80. Use models to develop and apply formulas for finding the area of a triangle and the volume of a rectangular solid.
	81. Apply the formula for finding the perimeter of a figure.
	82. Demonstrate an understanding of the relationship of length and width to the area of a rectangular region.
	83. Apply the formula for finding the area of a rectangular figure.

MATHEMATICS
FIFTH GRADE

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	84. Construct number sentences.
	85. Solve number sentences involving more than one operation.
	86. Determine the value of a variable in a number sentence using whole numbers and fractions.
	87. Identify a number sentence as open, true, or false; and supply a replacement for the variable that makes the sentence true.
EQUALITY RELATIONSHIPS	88. Know that two equivalent quantities remain equal when the same change takes place on each quantity. - Concrete objects - Pictures - Numbers - Symbols
PROPERTIES OF OPERATIONS	89. Classify number sentences that serve as examples of operations on numbers. - Identity elements for addition and multiplication - Commutative property of addition and multiplication - Associative property of addition and multiplication - Distributive property of multiplication over addition - Inverses for addition and multiplication
	90. Generalize and write number sentences (containing one variable) that serve as examples of properties of operations. Example: commutative property of addition $5 + b = b + 5$
	91. Develop an understanding of the order of operation. - Role of parentheses - Multiplication - Division - Addition - Subtraction

MATHEMATICS
FIFTH GRADE

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
CONCEPTS OF PATTERNS AND FUNCTIONS	92. State rule(s) governing a pattern.
	93. Generate and extend patterns.
	94. Determine a pattern and/or a function. Examples: act out a situation; draw a diagram; construct and read a graph; record and read information in simple tables
	95. Determine the value of a function for a given member of its domain. Example: function machine
	96. Identify and plot points in all quadrants of the Cartesian plane.

MATHEMATICS
FIFTH GRADE

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
LANGUAGE	97. Use the vocabulary of logic accurately in speaking and writing. - All - Some - None - Or - And - Every
REASONING	98. Use "if...then" statements.
	99. Determine whether conditional statements are true or false.
	100. Verbalize the steps involved in determining a valid conclusion for a set of premises.
	101. Formulate statements that reflect accurate conclusions about objects or situations.
	102. Determine whether sufficient information is given to solve problems.
SETS	103. Become aware of and use vocabulary associated with sets. - Set - Member/element - Subset - Empty set

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
STATISTICAL INFORMATION	104. Follow a logical process to collect, organize, and interpret information using calculators and computers where possible. - Make hypotheses - Gather data - Record data - Test hypotheses against recorded data - Organize and display data - Generalize findings - Analyze validity of hypotheses
	105. Select appropriate ways to organize and display data. Examples: frequency tables, graphs, charts, histograms
	106. Use the measures of central tendency to describe data. - Mean - Median - Mode
PROBABILITY OF EVENTS	107. Make predictions about outcomes of independent events.
	108. Discuss the possibility or impossibility of an event.
	109. Express, as a fraction, the probability of an event.

SIXTH GRADE

The sixth-grade mathematics program requires that students demonstrate proficiency in performing the basic operations with whole numbers and decimals. While time should be spent developing the ability to perform calculations with fractions, emphasis in fractional concepts should be on acquiring an understanding of the relationships among fractions, decimals, and percents and on learning how to apply that understanding in other situations. Students also should be involved in activities that enable them to develop skills related to ratio and proportion.

Students should be involved less with the rote practice of computational skills and should develop and use various techniques of mental arithmetic in calculating whole numbers, fractions, decimals, and percents. Use of calculators when computing large numbers and use of estimation skills when determining the appropriateness of an answer are recommended.

Students should estimate measurements, solve realistic problems involving measurement concepts, and develop skills related to scale drawings. Geometric concepts should include an understanding of volume, circumference, and geometric figures other than rectangles. Replacement sets for variables in an expression or a number sentence, determining and generating patterns, as well as plotting and locating points on the Cartesian plane, are included in the course work. Students should solve simple logic problems by acting out a situation or by making conjectures and drawing conclusions about the situation. Activities in statistics and probability should involve students in conducting surveys and selecting appropriate ways to organize, display, and interpret data.

At this grade level, an appreciation for mathematics can be fostered through the use of instructional strategies in which students apply problem-solving techniques, explore and examine realistic situations, and formulate questions to clarify their thinking and level of understanding.

MATHEMATICS
SIXTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
PLACE VALUE OF WHOLE AND DECIMAL NUMBERS	1. Identify place value of whole numbers and decimal numbers.
	2. Compare and order whole and decimal numbers.
	3. Write whole and decimal numbers in expanded notation.
	4. Write whole numbers in expanded form using exponential notation.
	5. Determine the value of a numerical expression written in exponential form.
ESTIMATION	6. Round whole and decimal numbers.
	7. Estimate sums, differences, products, and quotients of whole and decimal numbers.
	8. Approximate fractions to the nearest whole number.
ROMAN NUMERALS	9. Use Roman numerals as appropriate.
FACTORS AND MULTIPLES	10. Identify the exponent, base, and factors of a number in exponential form.
	11. Express prime factors of a number in exponential form.
	12. Demonstrate an understanding of perfect squares and perfect cubes.
	13. Use divisibility rules.
OPERATIONS ON WHOLE AND DECIMAL NUMBERS	14. Demonstrate proficiency in addition, subtraction, multiplication, and division. - Whole numbers - Decimal numbers - Money values
	15. Solve word problems involving whole numbers, decimal numbers, and money values.

MATHEMATICS
SIXTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
OPERATIONS ON WHOLE AND DECIMAL NUMBERS (continued)	16. Determine change, discounts, sales tax, unit pricing, cost of credit, and multiple purchasing.
	17. Compute wages without deductions.
	18. Determine and use the most appropriate method of calculation. - Paper/pencil - Mental arithmetic - Calculator - Computer
FRACTIONS	19. Use fractions as a form of division.
	20. Compare and order fractions.
	21. Simplify fractions.
OPERATIONS ON FRACTIONS	22. Add, subtract, and multiply fractions.
	23. Use the process of simplification when multiplying fractions.
	24. Demonstrate an understanding of the process of division of fractions.
	25. Divide fractions by multiplying by the reciprocal of the divisor.
	26. Solve simple problems involving fractions by using mental arithmetic.
	27. Solve word problems involving fractions.
	28. Use knowledge of fractions in problem solving situations.
INTEGERS	29. Relate the meaning of integers to specific examples.
	30. Locate integers on a number line.
	31. Compare and order integers.

MATHEMATICS
SIXTH GRADE

AREA: NUMBER

TOPICS	STUDENT OUTCOMES
	Students will
INTEGERS (continued)	32. Add and subtract integers. - Positive and positive - Positive and negative - Negative and negative
RATIOS, PROPORTIONS, AND PERCENTS	33. Express a fractional representation of a figure or set as a ratio.
	34. Express the comparison of two sets as a ratio.
	35. Express ratios using different forms. Examples: 2/3, 2:3, 2 to 3
	36. Name equivalent ratios.
	37. Determine the missing value that makes two ratios equivalent.
	38. Solve problems using ratios and proportions.
	39. Express fractions and ratios as equivalent percents.
	40. Recognize and identify the meaning of percent, percentage, and the percent symbol (%).
	41. Relate percents to parts of one hundred using fractional or decimal equivalents.
	42. Convert among percent, fractional, and decimal equivalents.
	43. Compute percent of a number.
	44. Find one number as a percent of another number.
	45. Find a number when percent and percentage are given.
	46. Solve problems involving percents.
	47. Compute simple percents using mental arithmetic.
	48. Use knowledge of percents in problem solving situations.

MATHEMATICS
SIXTH GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
MEASUREMENT CONCEPTS	49. Compare and order two or more angles based on size.
	50. Estimate length, weight, volume, capacity, or temperature in given situations.
STANDARD MEASUREMENT	51. Relate the historical development of measurement to standard units in the customary and metric systems of measurement. - Nonstandard units - Customary system - Metric system
	52. Become proficient in selecting and using appropriate measuring tools.
	53. Select and use appropriate customary and metric units of measurement. - Linear - Capacity - Mass/weight - Temperature - Area - Volume
	54. Measure angles using a protractor.
	55. Determine equivalent measurements based on conversions within a measurement system.
	56. Compare similar customary and metric units of measure. Examples: a kilometer is less than a mile; a liter is more than a quart; a meter is more than a yard

MATHEMATICS
SIXTH GRADE

AREA: MEASUREMENT

TOPICS	STUDENT OUTCOMES
	Students will
APPLICATIONS	57. Perform basic operations on units of measurement with regrouping. 58. Estimate and measure the perimeter of geometric figures. 59. Estimate the area of rectangular geometric figures, and verify the accuracy of the estimate. 60. Determine elapsed time. 61. Use knowledge of time zones to solve problems. 62. Use units of time and their equivalents to solve problems related to calendars and/or clocks. 63. Make simple scale drawings. 64. Read scale drawings. 65. Make two- and three-dimensional scale models of objects. 66. Solve problems based on knowledge and use of scale drawings. Use calculators and computers when appropriate.

MATHEMATICS
SIXTH GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
GEOMETRIC FIGURES	67. Make basic three-dimensional figures from two-dimensional figures and vice versa.
	68. Recognize spatial relationships in drawings of three-dimensional figures.
	69. Use knowledge of points, lines, line segments, rays, angles, perpendicular lines, and parallel lines to examine geometric figures and component parts.
	70. Classify plane and solid geometric figures based on attributes and properties.
	71. Identify and name component parts of plane and solid geometric figures.
	72. Draw angles using a protractor.
	73. Identify and draw right, acute, and obtuse angles.
	74. Construct plane geometric figures using a straightedge or a compass.
	75. Draw and label parts of a circle.
	76. Identify and construct triangles. - Equilateral - Scalene - Right - Isosceles - Acute - Obtuse
CONGRUENCE, SIMILARITY, AND SYMMETRY	77. Determine points of symmetry.
	78. Identify congruent figures and congruent parts of geometric figures.

MATHEMATICS
SIXTH GRADE

AREA: GEOMETRY

TOPICS	STUDENT OUTCOMES
	Students will
CONGRUENCE, SIMILARITY, AND SYMMETRY (continued)	79. Identify and use geometric transformations. - Flips - Turns - Slides
	80. Construct a line segment congruent to a given line segment.
	81. Bisect line segments using a compass.
	82. Bisect an angle.
COMBINING AND PARTITIONING	83. Determine the possible geometric figures that can combine to make a given shape.
	84. Partition geometric shapes into their basic geometric figures.
	85. Determine the area of a right triangle based on its relationship to a rectangle.
PERIMETER, AREA, CIRCUMFERENCE, AND VOLUME	86. Develop an understanding of the definition of pi (π).
	87. Demonstrate and become proficient in using measurement formulas. - Circumference of a circle - Area of a rectangle - Area of a triangle - Volume of a rectangular solid

MATHEMATICS
SIXTH GRADE

AREA: ALGEBRA

TOPICS	STUDENT OUTCOMES
	Students will
NUMERICAL RELATIONSHIPS	88. Construct number sentences.
	89. Identify a number sentence as open, true, or false; and supply a replacement for the variable that makes the sentence true.
	90. Solve number sentences.
	91. Find a missing number in a proportion.
	92. Know that two equal quantities remain balanced when the same change takes place on each quantity. - Concrete objects - Pictures - Numbers - Symbols
OPERATIONS ON VARIABLES	93. Classify number sentences that serve as examples of operations on numbers. - Identity elements for addition and multiplication - Commutative property of addition and multiplication - Associative property of addition and multiplication - Distributive property of multiplication over addition - Inverses for addition and multiplication
	94. Generalize and write number sentences (containing one variable) that serve as examples of properties of operations. Example: associative property of addition $(4 + a) + 7 = 4 + (a + 7)$
	95. Develop an understanding of the order of operations. - Role of parentheses - Multiplication - Division - Addition - Subtraction

MATHEMATICS
SIXTH GRADE

AREA: PATTERNS AND FUNCTIONS

TOPICS	STUDENT OUTCOMES
	Students will
CONCEPTS OF PATTERNS AND FUNCTIONS	96. Use number sentences to state a rule for a pattern.
	97. Predict an extension of a pattern based on knowledge of that pattern.
	98. Use calculators or computers to explore number patterns.
	99. Determine a pattern and/or a function. Examples: act out a situation; draw a diagram; construct and read a graph; record and read information in simple tables
	100. Determine the value of a function for a given member of its domain.
	101. Identify and plot points in all quadrants of the Cartesian plane.

AREA: LOGIC

TOPICS	STUDENT OUTCOMES
	Students will
LANGUAGE	102. Use the vocabulary of logic accurately in speaking and writing. - All - Some - None - Or - And - Every
REASONING	103. Formulate statements that reflect accurate conclusions about objects or situations.
	104. Use "if...then" statements to develop syllogisms.
	105. Determine whether conditional statements are true or false.
	106. Verbalize the steps involved in determining a valid conclusion for a set of premises.
SETS	107. Become aware of and use vocabulary associated with sets. - Set - Member/element - Subset - Empty set
	108. Recognize and use the symbols associated with sets. - Set - Subset - Element - Null (empty) set

MATHEMATICS
SIXTH GRADE

AREA: STATISTICS AND PROBABILITY

TOPICS	STUDENT OUTCOMES
	Students will
STATISTICAL INFORMATION	109. Formulate and test hypotheses concerning a situation to be examined.
	110. Collect, record, organize, and interpret data concerning a situation.
	111. Display data. Examples: box and whisker graphs, stem and leaf graphs, histograms
	112. Write findings that accurately describe data.
	113. Describe data through use of mean, median, and mode.
PROBABILITY OF EVENTS	114. List possible outcomes for an event.
	115. Make predictions about an outcome of independent events.
	116. Express the probability of an event as a fraction.

SEVENTH GRADE

Algebra is the area that unifies the seventh-grade mathematics course. Number concepts and operations should be viewed and studied algebraically. A minimal amount of time should be devoted to reviewing computational skills, and calculators should be used frequently so that students may focus on concepts and new content. The strong introduction to the fundamental concepts of algebra not only prepares students for high school mathematics but also enables them to see and appreciate the power of mathematics in solving problems.

MATHEMATICS
SEVENTH GRADE

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of rational numbers.	1. Define rational numbers.
	2. Identify subsets of rational numbers.
	3. Identify properties of rational numbers.
Demonstrate computational skills with rational numbers.	4. Perform basic arithmetic operations (addition, subtraction, multiplication, and division) on the set of rational numbers (positive, negative, and zero).
	5. Recognize and use various forms for representing rational numbers.
	6. Use the order of operations with rational numbers.
	7. Demonstrate an understanding of expanded notation and place value.
	8. Recognize and use absolute value.
Develop concepts and skills associated with number and the place value system.	9. Round whole numbers and decimals.
	10. Use additive and multiplicative laws of exponents to simplify arithmetic expressions involving positive integral exponents.
	11. Find and use the prime factorization of positive integers. - Least common multiple - Greatest common factor
	12. Find square roots of rational numbers.

MATHEMATICS
SEVENTH GRADE

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop concepts and skills associated with number and the place value system. (continued)	13. Convert numbers greater than one from base-ten notation to scientific notation and vice versa.
	14. Use the order relations (<, >, =, ≠) to compare and order rational numbers.
	15. Estimate answers to computational problems, and determine reasonableness of answers.
	16. Solve arithmetic problems choosing an appropriate method of calculation. - Estimation - Mental arithmetic - Paper and pencil - Calculator - Computer
Demonstrate an understanding of the computational skills in solving consumer-related problems.	17. Solve consumer-related problems. - Salaries, wages, and commissions - Unit cost - Amount of change from a purchase - Credit purchases - Interest/compound interest - Checking account - Shopping skills - Rate, distance, and time
Develop an understanding of ratio, proportion, and percent.	18. Recognize and use terminology of proportions. - Percent - Base - Percentage - Means, extremes
	19. Convert among percent, fractional, and decimal equivalents.
	20. Recognize and use the cross-product rule.

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of ratio, proportion, and percent. (continued)	21. Use ratios and proportions to solve problems. Examples: percent, scale drawings

MATHEMATICS
SEVENTH GRADE

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Extend the concept of measurement to include an understanding of uses and limitations.	22. Recognize that the best unit of measurement for a given purpose depends on the physical aspects of the object to be measured.
	23. Work with measurement of derived quantities. Examples: speed, acceleration, wind-chill factor
	24. Understand the approximate nature of measurement and the degree of error using the concept of rounding.
	25. Make two- and three-dimensional scale models.
Understand and use various systems of measurement, including the metric and customary systems.	26. Convert units of measure within a system of measurement. - Length - Area - Volume - Time - Capacity - Weight/mass - Money
	27. Add, subtract, multiply, and divide. - Length - Area - Volume - Time - Capacity - Weight/mass - Money

MATHEMATICS
SEVENTH GRADE

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Understand and use various systems of measurement, including the metric and customary systems. (continued)	28. Solve problems. - Time - Distance/length - Rate - Money - Capacity - Weight/mass - Area - Volume - Temperature
	29. Use tools of measurement.
	30. Recognize the use of place value within the metric system.
	31. Estimate lengths and capacities.

MATHEMATICS
SEVENTH GRADE

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the vocabulary, symbols, and figures of geometry.	32. Recognize and identify convex figures. Examples: trapezoids, rectangles, parallelograms, triangles
	33. Classify triangles by sides and angles.
	34. Use a compass and a straightedge to construct geometric figures. - Bisector of a line segment - Bisector of an angle - Regular hexagons - Perpendicular lines
	35. Determine symmetry. - Line - Point - Plane
	36. Describe relationships between pairs of angles. - Adjacent - Vertical - Complementary - Supplementary
	37. Recognize and identify solid geometric figures. Examples: prisms, spheres, cylinders, cones

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the vocabulary, symbols, and figures of geometry. (continued)	38. Use correct formulas to determine each of the following: - Perimeter of polygons - Circumference of circles - Area of circles and polygons - Volume of spheres, rectangular solids, and cylinders - Surface area of spheres, rectangular solids, and cylinders 39. Find perimeter, area, surface area, and volume of irregular geometric shapes.
Demonstrate an understanding of coordinate geometry.	40. Identify characteristics of lines parallel to and perpendicular to the X and Y axes in the coordinate plane. 41. Write equations of lines parallel to and perpendicular to the X and Y axes in the coordinate plane.

AREA: **ALGEBRA**

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of mathematical algebraic expressions.	42. Use language associated with algebraic expressions. - Variable - Term - Coefficient - Exponents - Phrase - Sentence - Constant
	43. Substitute numerical values for variables in algebraic expressions; then, use the order of operations to evaluate the expressions.
	44. Simplify linear algebraic expressions.
	45. Translate verbal phrases and sentences into algebraic expressions and vice versa.
	46. Perform arithmetic operations on algebraic expressions.
	47. Factor a common monomial from an algebraic expression.
	48. Multiply two binomials using the distributive property.
Demonstrate the ability to solve algebraic equations and inequalities.	49. Find solutions to equations by substituting values from a given set for the variable.
	50. Determine which members of a given set are solutions to a linear inequality.
	51. Solve linear equations equivalent to the form $ax + b = c$.
	52. Solve linear inequalities equivalent to the form $ax + b > c$, and graph the solution set on a number line.

MATHEMATICS
SEVENTH GRADE

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the ability to solve algebraic equations and inequalities. (continued)	53. Use linear equations to solve a variety of problems. Examples: ratio, proportion, percent 54. Solve algebraic problems using calculators and computers when appropriate.
Develop an understanding of the properties of numbers.	55. Demonstrate and use properties of rational numbers. - Distributive property of multiplication over addition - Closure for addition and multiplication - Associative properties for addition and multiplication - Commutative properties for addition and multiplication - Identities for addition and multiplication - Inverses for addition and multiplication 56. Explore the density of rational numbers using a number line and averaging. 57. Investigate the additive and multiplicative laws of exponents, and use them appropriately. 58. Determine and use appropriate inverse operations to solve equations.

MATHEMATICS
SEVENTH GRADE

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of pattern.	59. Analyze sequences. Examples: numbers, figures, symbols
	60. Create sequences. Examples: numbers, figures, symbols
	61. Use number patterns in problem solving.
	62. Recognize and explore patterns in the environment. Examples: music, art, nature
Demonstrate an understanding of the concept of function.	63. Determine the value of a function for a given value of the variable.
	64. Determine a function rule that represents a relationship.
	65. Identify and determine the domain and range of a function.

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the terms and principles of logic.	66. Understand and use terms associated with logical reasoning. - All - Some - And - If...then - Not - Or
	67. Understand the meaning of the logical connective "if and only if."
	68. Determine the equivalence of conditional statements.
	69. Develop an awareness of inductive and deductive reasoning.
Apply formal reasoning processes.	70. Determine validity of simple and complex arguments.
	71. Develop flow charts.
	72. Analyze the reasoning involved in simple flow charts.
	73. Use sets in problem solving.
Develop an understanding of the terminology of set theory.	74. Represent a given set in various ways. - Roster - Definition
	75. Recognize and use the vocabulary of set theory. - Element - Subset - Null (or empty) set - Intersection - Union

MATHEMATICS
SEVENTH GRADE

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the uses of data.	76. Collect and organize data using lists, tables, and graphs.
	77. Interpret and analyze data using lists, tables, and graphs.
Demonstrate an understanding of statistical measures.	78. Compute mean, median, mode, and range for a set of data using calculators when appropriate.
	79. Select appropriate measures to interpret a set of data.
Demonstrate an understanding of the principles of probability.	80. Determine possible outcome(s) of an event.
	81. Determine the number of permutations or combinations.
	82. Determine the probability of simple events.
	83. Compare probability with experimental outcomes.
	84. Express probability as a ratio or fraction.

EIGHTH GRADE

The eighth-grade mathematics course emphasizes geometry. The algebraic concepts introduced in grade seven are extended and applied to geometry. The material in this course should be presented concretely through the use of manipulatives. Calculators and computers should be used, when appropriate, so that students can focus on and better understand concepts. The introduction to the methods of geometry and the extended investigation of geometric shapes and graphs provide the foundation for students to pursue further study of mathematics in either a college-preparatory program or technical training program.

MATHEMATICS
EIGHTH GRADE

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop concepts and skills associated with number.	1. Use the laws of exponents to simplify arithmetic expressions involving integral exponents. 2. Convert rational numbers from base ten notation to scientific notation and vice versa. 3. Multiply numbers in scientific notation. 4. Find and use the prime factorization of positive integers. - Least common multiple - Greatest common factor 5. Find square roots of rational numbers. 6. Estimate answers and determine reasonableness of answers. 7. Solve arithmetic problems choosing an appropriate method of calculation. - Estimation - Mental arithmetic - Paper and pencil - Calculator - Computer 8. Develop an awareness of terminology associated with the set of real numbers. Examples: subsets, location on the number line

MATHEMATICS
EIGHTH GRADE

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate computational skills with rational numbers.	9. Demonstrate proficiency with the basic arithmetic operations and with the order of operations on the set of rational numbers.
	10. Recognize and use various forms for representing rational numbers.
Demonstrate an understanding of ratio, proportion, and percent.	11. Use ratio and proportion to solve problems. Examples: scale drawings, similar triangles, base, rate, and percentage
	12. Solve problems using percents. Examples: tax, discount, commission

MATHEMATICS
EIGHTH GRADE

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Extend concept of measurement to include an understanding of uses and limitations.	13. Recognize that the best type of measurement for a given purpose depends on the physical aspects of the object to be measured.
	14. Work with measurement of derived quantities. Examples: speed, acceleration, wind-chill factor
	15. Measure to a specified degree of accuracy.
	16. Make two- and three-dimensional scale models.
Understand and use various systems of measurement.	17. Convert units of measure within a system of measurement. - Time - Money - Length - Area - Volume - Capacity - Weight/mass
	18. Develop an awareness of approximate equivalent measurements between customary and metric units.
	19. Add, subtract, multiply, and divide using specified units. - Time - Money - Length - Area - Volume - Capacity - Weight/mass

MATHEMATICS
EIGHTH GRADE

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Understand and use various systems of measurement. (continued)	20. Solve problems. - Time - Distance - Rate - Money - Capacity - Weight/mass - Area - Volume - Temperature
	21. Use tools of measurement.
	22. Estimate lengths, areas, volumes, and weights; verify estimates by measuring.

MATHEMATICS
EIGHTH GRADE

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of terms, vocabulary, symbols, and figures of geometry.	23. Recognize and identify geometric figures.
	24. Know that plane geometric figures have two dimensions.
	25. Know that solid geometric figures have three dimensions.
	26. Distinguish between plane and solid geometric figures.
	27. Identify angles and their characteristics. - Right, acute, obtuse, straight - Adjacent, vertical - Complementary, supplementary
	28. Recognize, identify, and use parallel, transversal, perpendicular, and skew lines.
	29. Recognize and describe the relationship of angles formed by two parallel lines cut by a transversal.
	30. Identify figures and parts of figures that are congruent.
	31. Identify and use parts of a circle.
	32. Classify polygons.
	33. Identify models of a geometric plane.
	34. Use compass and straightedge to construct geometric figures. - Perpendicular bisector of a given line segment - Angle congruent to a given angle - Line segment congruent to a given line segment - Congruent triangles - Parallel lines - Regular polygons - Right triangles

MATHEMATICS
EIGHTH GRADE

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of terms, vocabulary, symbols, and figures of geometry. (continued)	35. Apply formulas of plane geometry.
	36. Recognize and use the Pythagorean Theorem.
	37. Synthesize facts about geometric figures in order to draw conclusions.
	38. Select and use an appropriate formula and procedure to determine a measurement.
	39. Choose appropriate units of measure and use the correct formula for each. - Perimeter of polygons - Circumference of circles - Area of circles and polygons - Volume of spheres, prisms, pyramids, cylinders, and cones - Surface area of spheres, prisms, pyramids, cylinders, and cones - Measurement of angles
	40. Find perimeter, area, surface area, and volume of irregular geometric figures.
Develop an understanding of the properties of the coordinate plane.	41. Develop the Cartesian plane. - Perpendicular number lines - Origin - Abscissa - Ordinate
	42. Locate points in the Cartesian plane.
	43. Identify and use geometric transformations. - Slides - Flips - Rotations

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the properties of the coordinate plane. (continued)	44. Identify the characteristics that determine the equation of lines. - Parallel to coordinate axes - Perpendicular to coordinate axes
	45. Use computer and graphing software to facilitate understanding of the coordinate plane.

MATHEMATICS
EIGHTH GRADE

AREA: **ALGEBRA**

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of mathematical/algebraic expressions.	46. Review language associated with algebraic expressions. - Variable - Term - Coefficient - Exponent - Phrase - Sentence - Constant
	47. Substitute numerical values for variables in algebraic expressions, and use the order of operations to simplify these expressions.
	48. Simplify linear algebraic expressions.
	49. Translate verbal phrases and sentences into algebraic expressions and vice versa.
	50. Factor a common monomial from an algebraic expression.
	51. Become aware of models of algebraic expressions. Examples: $x^2 + bx + c$, conic sections
	52. Simplify algebraic expressions. - Combining like terms - Using laws of exponents restricted to positive integer exponents - Using the distributive property
Solve algebraic equations and inequalities.	53. Solve linear equations and inequalities.
	54. Use linear equations to solve problems. Examples: ratio, proportion, percent
	55. Solve algebraic problems using calculators and computers when appropriate.

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Solve algebraic equations and inequalities. (continued)	56. Solve for any variable in a formula. 57. Solve linear equations involving absolute value.
Develop an understanding of properties of numbers.	58. Demonstrate and use field properties of rational numbers.

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of pattern.	59. Analyze and create sequences. Examples: numbers, figures, symbols
	60. Know the rule that determines a pattern.
	61. Use number patterns in problem solving.
	62. Recognize patterns in the environment. Examples: music, art, nature
Demonstrate an understanding of the concept of function.	63. Determine the value of a function for a given element of the domain.
	64. Determine a function rule that represents a relationship.
	65. Recognize graphs on a coordinate plane that illustrate symmetry and the reflective property.

MATHEMATICS
EIGHTH GRADE

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of terms and principles of logic.	66. Use terms of logic. - And - If...then - If and only if - Not - Or - Only
	67. Determine equivalence of conditional statements.
	68. Recognize and use inductive and deductive reasoning.
	69. Recognize difference between a necessary condition and a sufficient condition.
Apply formal reasoning processes.	70. Determine validity of simple and complex arguments.
	71. Recognize and explain flaws in invalid arguments.
	72. Develop flow charts.
	73. Analyze the reasoning in simple flow charts.
	74. Use sets in problem solving.
Develop an understanding of elementary set theory.	75. Represent a given set in various ways.
	76. Use the vocabulary of sets. - Element - Subset - Finite - Infinite - Null or empty - Equivalent - Equal

MATHEMATICS
EIGHTH GRADE

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of elementary set theory. (continued)	77. Understand and use operations on sets. - Union - Intersection - Complement
	78. Use symbols for intersection, union, and empty set.

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the uses of data.	79. Collect data, and use computers and appropriate software to organize data.
	80. Interpret and analyze data using lists, tables, and graphs.
	81. Analyze published studies.
Demonstrate an understanding of statistical measures.	82. Compute mean, median, mode, and range for a set of data using a calculator when appropriate.
	83. Select the appropriate measure to interpret a set of data.
	84. Identify use and misuse of statistics in everyday life.
	85. Conduct a statistical study.
Demonstrate an understanding of the principles of probability.	86. Determine possible outcome(s) of an event.
	87. Determine the number of permutations or combinations.
	88. Determine the probability of simple events.
	89. Compare probability with experimental outcomes.
	90. Determine the probability of complementary events and of mutually exclusive events.

GENERAL MATHEMATICS

General Mathematics includes content which requires students to learn mathematics beyond the scope of the kindergarten through eighth-grade program. All students graduating from high school need a basic understanding of algebra and geometry; therefore, the course includes some concepts of algebra and geometry. The course does not require students to begin a traditional college-preparatory sequence; however, it does not preclude such a choice. Students could, after the successful completion of the course, transfer to the college-preparatory sequence. Instruction in General Mathematics should focus on concrete applications as opposed to abstract applications. Students should be given instruction in the use of the calculator and the computer. Particular emphasis should be placed on the use of technology to facilitate problem-solving situations.

GENERAL MATHEMATICS

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Student will
Demonstrate an understanding of the order of rational numbers.	1. Place subsets of rational numbers on the number line.
	2. Compare and order. - Integers - Fractions - Decimals - Fractions and decimals
Demonstrate an understanding of the concepts and skills associated with real numbers.	3. Add, subtract, multiply, and divide rational numbers.
	4. Use laws of exponents to perform arithmetic operations with rational and irrational numbers.
	5. Determine square roots of whole numbers, fractions, and decimals when the square root is a rational number.
	6. Estimate square roots. Use calculators to validate estimates.
	7. Use estimation to approximate sums, differences, products, and quotients and to determine reasonableness of answers.
	8. Perform operations with numbers in scientific notation.
	9. Determine absolute value.
	10. Solve word problems using calculators when appropriate.

GENERAL MATHEMATICS

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of ratios, proportions, and percents.	11. Write and use ratios to compare one quantity to another. 12. Recognize percents as ratios. 13. Develop problem-solving skills. - Base, rate, and percentage - Discount - Sale price - Tax - Scale drawings
Demonstrate an understanding of the properties of real numbers.	14. Apply the order of operations. 15. Recognize symbols of inclusion and perform operations involving symbols. 16. Use field properties of real numbers. - Identity - Inverse - Commutative - Distributive - Closure - Associative 17. Demonstrate density of rational numbers.
Demonstrate an understanding of the computational skills in solving consumer-related problems.	18. Write equivalent forms of numbers. - Fractions as decimals and percents - Decimals as fractions and percents - Percents as decimals and fractions 19. Solve consumer-related problems. - Salaries, wages, and commissions - Unit cost - Amount of change from a purchase - Credit purchases - Interest/compound interest - Checking account - Shopping skills - Rate, distance, and time

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will Demonstrate an understanding of measurement in the customary system and in the metric system.	Students will 20. Estimate, find, and use measurement to describe, compare, or contrast objects in real world situations. 21. Select and use appropriate units of measure and tools to measure dimensions. 22. Change units of measurement within a system. - Linear - Capacity - Mass/weight - Time 23. Determine the circumferences of circles. 24. Determine the perimeters of polygons. 25. Determine area. - Rectangles - Squares - Parallelograms - Triangles - Trapezoids - Circles - Regular polygons - Irregular polygons 26. Determine surface area and volume. - Prisms - Pyramids - Cylinders - Cones - Spheres 27. Add and subtract units of measurement. 28. Determine beginning, ending, and elapsed time.

GENERAL MATHEMATICS

AREA: **MEASUREMENT**

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of measurement in the customary system and in the metric system. (continued)	29. Develop problem-solving skills that involve measurement using calculators when appropriate.

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the principles of geometry.	30. Identify plane and solid geometric figures. - Regular polygons - Regular polyhedrons - Stellated polyhedrons
	31. Demonstrate an understanding of the concepts related to geometric figures. Examples: classifications of angles, classifications of polygons
	32. Use properties of angles, triangles, polygons, and circles. Examples: sums of angle measures of polygons
	33. Recognize and use congruent and similar polygons.
	34. Apply properties and theorems of right triangles in practical problems. - Trigonometric ratios - Pythagorean Theorem
	35. Graph linear equations and inequalities using computers when appropriate.
Develop an understanding of the principles of construction.	36. Use straightedge and compass to perform basic constructions. Examples: perpendicular lines, midpoints of line segments, angles congruent to given angles, bisectors of angles, parallel lines
	37. Use basic constructions to determine sets of points satisfying given conditions.

GENERAL MATHEMATICS

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of variable expressions.	38. Recognize variable expressions.
	39. Perform arithmetic operations on variable expressions.
	40. Write mathematical expressions demonstrating knowledge of reflexive, symmetric, transitive, commutative, associative, and distributive properties.
	41. Evaluate variable expressions.
	42. Translate verbal, symbolic, and/or pictorial expressions into algebraic expressions.
	43. Factor algebraic expressions.
Demonstrate an understanding of open sentences.	44. Express as inequalities phrases that use terms such as at least, at most, less than, more than.
	45. Solve one-step equations and inequalities.
	46. Solve multistep equations.
	47. Recognize formulas as equations, and solve for a given variable.
	48. Solve word problems using calculators when appropriate. - Equalities - Inequalities
	49. Solve open sentences involving absolute value.
	50. Solve systems of linear equations. - By graphs - By substitution - By elimination
	51. Solve quadratic equations by factoring.

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of number patterns.	52. Identify the pattern of a sequence of numbers.
	53. Create a sequence of numbers when given the rule.
	54. Use number patterns as a problem-solving technique.
Demonstrate an understanding of functions and relations.	55. Graph points on the Cartesian plane.
	56. Recognize a relation as a set of ordered pairs.
	57. Determine when a relation is a function.
	58. Determine the characteristics of a function.
	59. Graph linear functions.

GENERAL MATHEMATICS

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will:	Students will:
Develop an understanding of the principles of logic.	60. Interpret and use logic statements. Examples: negation, conjunction, disjunction, conditional
	61. Interpret statements using quantifiers. Examples: all, every, none, some
	62. Draw valid conclusions from given information.
	63. Determine validity of simple and complex arguments.
	64. Construct flow charts.
Develop an understanding of elementary set theory.	65. Use sets in problem solving.
	66. Represent a given set in various ways.
	67. Use the vocabulary of set theory. - Element - Subset - Finite - Infinite - Null or empty - Equivalent and equal
	68. Use operations of sets. - Union - Intersection - Complement
	69. Use symbols of set theory.

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the uses of data.	70. Collect and organize data.
	71. Present data in graphical form. - Scatter plots - Bar graphs - Circle graphs - Line graphs - Picture graphs - Stem and leaf plots - Box and whisker plots
	72. Interpret data from tables, charts, and graphs.
Demonstrate an understanding of statistical measures.	73. Define mean, median, mode, and range.
	74. Compute mean, median, mode, and range using calculators when appropriate.
	75. Select appropriate measure(s) for a given set of data.
	76. Distinguish between use and misuse of statistics.
Demonstrate an understanding of probability.	77. Distinguish between inclusive and exclusive events.
	78. Distinguish between dependent and independent events.
	79. Make predictions of outcomes involving equally likely events.
	80. Use probability techniques in problem solving. Use calculators when appropriate.

CONSUMER MATHEMATICS

Consumer Mathematics is designed primarily to prepare young adults for living in a technological society that requires a high level of mathematical understanding. Additional emphasis is devoted to consumer/business application skills. Course work should be activity-oriented concentrating on the concepts of mathematics that have not been emphasized in previous courses. This course is appropriate for students preparing to become independent consumers in our society.

CONSUMER MATHEMATICS

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the use of numbers to compute consumer costs.	1. Compute and compare hourly, weekly, monthly, and annual salaries.
	2. Identify various types of salary deductions, and compute net pay.
	3. Reconcile a bank statement.
	4. Determine and complete appropriate income tax forms using computers when appropriate.
	5. Compute commission.
	6. Compute and compare unit costs.

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the ability to use and apply measurement skills.	7. Change units of measurement within a system. - Linear - Area - Volume - Capacity - Mass/weight - Time
	8. Determine appropriate units of measure.
	9. Select and use appropriate measuring devices. Examples: rulers, tape measures, scales, micrometers, cups, spoons, utility meters
	10. Determine perimeter and area of polygons and circles.
	11. Determine elapsed time. - Beginning time/ending time - Date of maturity of a loan or a certificate of deposit - Transportation schedule
	12. Determine volume. - Cylinders - Spheres - Parallelepiped - Pyramids
	13. Add and subtract units of measurement in problem solving.

CONSUMER MATHEMATICS

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the ability to apply geometric concepts to consumer skills.	14. Interpret and use scale drawings.
	15. Use perimeter, area, and volume in solving problems.
	Examples: carpet a home; paint a home; fence an area; frame a picture; sew an article of clothing; use a recipe

CONSUMER MATHEMATICS

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the ability to apply algebraic concepts to consumer skills.	16. Compute costs of mortgages at different rates and for different time frames using calculators and computers when appropriate.
	17. Determine monthly payments on installment loans. Examples: automobile, boat, stereo, house
	18. Investigate and compute utility costs.
	19. Compute the cost of gasoline in the operation of an automobile.
	20. Compute simple and compound interest on savings accounts using computers when appropriate.
	21. Compute the cost of credit. Examples: charge accounts, installment loans, credit cards
	22. Identify and compute various taxes using calculators and computers when appropriate. - Property - Sales - Excise - Inheritance - Gift - Use

CONSUMER MATHEMATICS

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the ability to determine patterns and functions related to consumer skills.	23. Identify factors and determine costs of operating an automobile.
	24. Use problem-solving skills to investigate methods or factors involved in deceptive or fraudulent pricing. Examples: schemes(home improvement, vacations, diploma mills, etc.), games of chance, flimflams, land sales, swindles
	25. Identify and compute costs associated with trip planning. - Routes - Fares - Schedules
	26. Use special functions, such as the step function, to make comparisons associated with consumer costs. Examples: postage rates, trip fares, shipping charges

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the application of logical thinking skills to the making of consumer decisions.	27. Compare the return on various types of investments. Examples: stocks, bonds, savings, land, real estate, antiques, art, jewelry
	28. Determine appreciation or depreciation, and evaluate the impact on purchases.
	29. Recognize fallacies in logical arguments as they relate to consumer decisions. Examples: advertising, warranties/guarantees, credit plans, insurance, travel costs
	30. Compute costs, and compare advantages and disadvantages of renting/leasing versus buying. Examples: automobiles, furniture, appliances, audio/video equipment, home
	31. Compare and evaluate banking services. Examples: checking accounts, saving accounts, certificates of deposit
	32. Identify costs/consumer responsibilities associated with credit. Examples: liability for consumer-purchased items, stolen credit cards

CONSUMER MATHEMATICS

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the application of logical thinking skills to the making of consumer decisions. (continued)	33. Evaluate various types of insurance based on need/cost. - Health - Life - Home - Auto
	34. Develop personal budgets, and determine impact of purchases.
	35. Identify factors which influence costs of licenses and permits, and use problem-solving skills to identify responsibilities associated with each. Examples: sale of alcoholic beverages to minors, safe preparation of food in restaurants, safe driving practices
	36. Read and interpret tables. Examples: postage rates, telephone rates, tax, distance between cities, nutrition

CONSUMER MATHEMATICS

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the application of probability and statistics to consumer skills.	37. Apply probability of events to relevant experiences. Examples: weather, insurance, charts for life expectancy
	38. Compute the relative frequency or probability of an event.
	39. Compute the probability of independent and dependent events.
	40. Describe and use various methods of collecting data.
	41. Define and compute mean, mode, median, and range.
	42. Compare and contrast the ways in which mean, mode, and median can be used to alter the presentation of data.
	43. Distinguish between use and misuse of statistics.
	44. Interpret statistical data. Examples: proportionate representation of graphs, distortions of graphs, appropriate sampling
	45. Read and interpret tables. Examples: postage rates, telephone rates, mileage
	46. Use and interpret graphs. Use computers when appropriate.

ALGEBRA I

Algebra I is a rigorous study of the fundamental structure of the real number system. It is intended that attention be given to the algebraic properties and operations throughout the course. Application should be integrated into all topics. Calculator use should be encouraged when appropriate so that students may be free to concentrate on the development of problem solving and other higher-order thinking skills.

All students with the mathematical background and ability to enter a college-preparatory program should be strongly encouraged to take this course. It should also be a recommended elective for those who are considering postsecondary education in technical or trade fields.

ALGEBRA I

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the basic symbolism and terminology of algebraic numbers.	1. Define sets of numbers. - Natural numbers - Integers - Rational numbers - Irrational numbers - Real numbers
	2. Graph real numbers on the number line.
	3. Perform operations with any subset of the set of real numbers.
	4. Use the four operations and exponentiation to simplify numerical and algebraic expressions.
	5. Use the correct order of operations to simplify expressions.
	6. Compare and compute within the set of irrational numbers using calculators when appropriate.
	7. Perform operations involving square roots.
	8. Recognize and use the number properties.

ALGEBRA I

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES
Students will		Students will
Recognize and develop an understanding of the concept of absolute value.	9.	Recognize absolute value of a number as its distance from the origin.
	10.	Use absolute values of real numbers to measure lengths of line segments.
Demonstrate an understanding of formulas related to measurement.	11.	Derive the distance formula.
	12.	Use the distance formula to find the lengths of line segments.
	13.	Apply appropriate formulas to determine perimeters and areas of polygons and circles using calculators when appropriate.
	14.	Apply appropriate formulas to determine volumes of geometric solids using calculators when appropriate.

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	**Students will**
Demonstrate an understanding of the relationship between geometric models and algebraic expressions.	15. Graph the solution sets of linear inequalities in one variable on the number line.
	16. Apply the terminology associated with Cartesian planes to the graphing of equations.
	17. Graph linear equations and inequalities.
	18. Use transformations to sketch the graphs of functions. Examples: absolute value function, square root function, squaring function
	19. Graph a line when given two conditions. - Two points - Point and slope - Intercepts
	20. Graph systems of linear equations and inequalities.
	21. Use the properties of angles, triangles, and similar triangles to solve problems.

ALGEBRA I

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the concept of algebraic expressions.	22. Perform basic arithmetic operations on algebraic expressions.
	23. Evaluate algebraic expressions.
	24. Translate verbal, symbolic, and/or pictorial expressions into algebraic expressions.
	25. Recognize and use the vocabulary associated with polynomials.
	26. Use the four operations and exponentiation on polynomial expressions.
	27. Factor algebraic expressions.
	28. Determine the restrictions on the domain of a variable in an algebraic expression.
Demonstrate an understanding of open sentences.	29. Use the terminology and symbolism associated with equations.
	30. Determine the solution sets of linear equations over specified domains.
	31. Use the properties of numbers to solve linear equations.
	32. Solve equations involving fractions.
	33. Solve literal equations for any variable.
	34. Determine the equation of a line satisfying two conditions. Examples: two points, point and slope, intercepts

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of open sentences. (continued)	35. Solve word problems involving open sentences. Use calculators when appropriate.
	36. Use algebraic models in problem solving.
	37. Use the order relationships of real numbers.
	38. Use the properties of numbers to solve inequalities.
	39. Solve word problems involving inequalities.
	40. Solve systems of linear equations.
	41. Solve word problems using systems of linear equations.
	42. Solve systems of linear inequalities.
	43. Solve quadratic equations in one variable.
	44. Solve word problems using quadratic equations in one variable.
	45. Solve equations and inequalities involving absolute values.

ALGEBRA I

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of relations and functions.	46. Recognize a relation as a set of ordered pairs.
	47. Recognize a function as a relation.
	48. Define a function in terms of a mapping.
	49. Evaluate a function for given values in its domain.
	50. Use open sentences to describe functions and other relations. - Direct variations - Constant functions - Inverse variations
	51. Use tables and graphs to describe functions.
	52. Graph functions and other relations.
	53. Solve problems involving functions.

ALGEBRA I

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Recognize and understand the properties of logic, and be able to apply them.	54. Recognize and use number properties as justifications in algebraic proofs. - Commutative property of addition and of multiplication - Associative property of addition and of multiplication - Identity element of addition and of multiplication - Inverse of addition and of multiplication - Distributive property of multiplication over addition - Properties of equality · Reflexive · Symmetric · Transitive · Substitution · Addition · Multiplication - Properties of inequality

ALGEBRA I

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the application of probability and statistics from an algebraic standpoint.	55. Interpret data using graphs. - Scatter plots - Stem and leaf graphs - Line graphs - Histograms - Box and whisker graphs 56. Analyze data using measures of central tendency. - Mean - Median - Mode 57. Understand and determine measures of variability. - Range - Variance 58. Distinguish between sample and population. 59. Compare the mean of a sample with the mean of the population. 60. Demonstrate an understanding of the relationship between estimated and theoretical probability. 61. Demonstrate an understanding of the difference between dependent and independent events. 62. Apply multiplication principle to determine the probability of independent events and dependent events. 63. Apply addition principle to determine the probability of independent events and dependent events.

UNIFIED GEOMETRY

Geometry is the formal development of those geometric skills and concepts prerequisite to Algebra II and/or other advanced college-preparatory courses. The course includes consistent use of algebra to reinforce the skills and concepts developed in Algebra I. Course work should provide for exploratory development of the formal representation of logical arguments as well as application of logical principles to geometric proofs. Problem-solving skills in the development of geometric concepts should be integrated throughout the course. Trigonometry is included in the course to prepare students for the development of circular function trigonometry in later courses.

UNIFIED GEOMETRY

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Reinforce skills of ordering real numbers on the real number line.	1. Use construction to locate on a number line a point whose coordinate is irrational.

UNIFIED GEOMETRY

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will Demonstrate an understanding of measurement of geometric figures.	Students will 2. Distinguish among lines, rays, and segments. 3. Determine distance on a number line. 4. Use the distance formula to determine the length of line segments. 5. Apply the Protractor Theorem to the measurement of angles, and use measurement to determine congruence. 6. Classify angles by types according to measurement. 7. Determine the measure of angles. Examples: angles associated with polygons, circles, parallel lines, polyhedrons, dihedral angles 8. Determine arc length. 9. Determine the circumference of a circle. 10. Understand and work problems related to circles. - Concentric circles - Intersecting circles - Disjunct circles - Internally tangent circles - Externally tangent circles 11. Determine the area of a circle. 12. Solve problems using the Sum of the Angles Theorem and its corollaries.

UNIFIED GEOMETRY

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of measurement of geometric figures. (continued)	13. Use a compass and straightedge for geometric constructions. Examples: parallel lines, perpendicular lines, equal line segments 14. Determine perimeter and area of polygons. 15. Identify and use formulas to find the surface area and volume.

UNIFIED GEOMETRY

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the structure of geometry.	16. Demonstrate an understanding of the term "Euclidean geometry," and know the fundamental proposition of Euclidean geometry.
	17. Know the geometric postulates upon which Euclidean geometry is based.
	18. List, discuss, and represent the undefined terms of Euclidean geometry.
	19. Know definitions of defined terms of Euclidean geometry.
	20. Understand geometric theorems and corollaries.
	21. Represent and use geometric symbols and notations.
	22. Distinguish Euclidean geometry from non-Euclidean geometries.
Develop an understanding of geometric relationships.	23. Know the definitions and properties relative to angles, parallel lines and planes, perpendicular lines and planes, circles and spheres, and polygons and polyhedrons.
	24. Describe and use special relationships between pairs of angles. - Adjacent angles - Vertical angles - Complementary angles - Supplementary angles - Corresponding angles of parallel lines cut by a transversal - Alternate interior angles of parallel lines cut by a transversal
	25. Apply properties of similar polygons in problem solving.

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of geometric relationships. (continued)	26. Apply properties of congruent polygons to solutions of problems and proofs of other theorems.
	27. Use geometric relationships relating to circles and spheres. Examples: tangents, chords, secants, inscribed figures, circumscribed figures, central angles, inscribed angles, angles formed by a tangent and a chord, angles formed by two secants intersecting inside the circle, angles formed by two secants intersecting outside the circle
	28. Classify triangles.
	29. Classify polyhedrons.
	30. Construct polyhedrons.

UNIFIED GEOMETRY

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of the relationships between algebra and geometry.	31. Understand the special relationships of the number lines that determine the Cartesian plane.
	32. Locate points in the Cartesian plane.
	33. Know the definitions of the terms abscissa and ordinate.
	34. Relate points in Cartesian planes to the terms abscissa and ordinate.
	35. Use the Pythagorean Theorem to develop the distance formula in three dimensions.
	36. Know the definition of the term slope.
	37. Use the slope formula.
	38. Use the midpoint formula.
	39. Determine the equation of a line satisfying two given conditions. Examples: two points, point and slope, intercepts
	40. State the relationship of the slopes of parallel lines and of the slopes of perpendicular lines.
	41. Develop proofs using coordinate methods.
	42. Apply the Pythagorean Theorem in problem solving using calculators when appropriate.
Demonstrate an understanding of similar triangles and their properties.	43. Use the corresponding sides of similar triangles to set up proportions.
	44. Solve proportions.
	45. Solve problems using ratio and proportion.

UNIFIED GEOMETRY

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of triangle inequalities.	46. Apply triangle inequality theorems in problem solving.
Demonstrate an understanding of the concepts of area and volume.	47. Derive formulas for finding areas of polygonal regions.

UNIFIED GEOMETRY

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Recognize and describe geometric patterns and functions.	48. Describe ellipse, parabola, circle, and hyperbola as loci of points in a plane.
	49. Determine intersections of loci.
	50. Describe conic sections as the intersection of a plane and a cone.
	51. Describe the loci of points in a plane or in space that satisfy given conditions.
	52. Describe points of concurrency in a triangle as a locus of points. - Altitudes - Medians - Centroid - Angle bisectors
Demonstrate an understanding of the mapping of a function.	53. Know and use terms associated with mapping.
	54. Express a function as a mapping.
	55. Demonstrate reflections, translations, and rotations.
	56. Apply point, line, and plane symmetry to the location of points in a plane or in space.
Demonstrate an understanding of the right triangle definitions of trigonometric functions.	57. Know the right triangle definitions of the sine, cosine, and tangent functions.
	58. Use the sine, cosine, and tangent functions to solve problems.
	59. Apply the properties of 30-60-90 and 45-45-90 degree triangles to determine the values of the sine, cosine, and tangent of 30-, 45-, and 60-degree angles.
	60. Use Pythagorean triples to determine sine, cosine, and tangent values of angles.

UNIFIED GEOMETRY

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of symbolic logic and its relationship to geometric proof.	61. Apply the principles of symbolic logic to the concept of proof. Example: principle of deduction
	62. Distinguish between inductive and deductive reasoning.
	63. Distinguish between direct and indirect proof.
	64. Use deductive reasoning to construct formal geometric proofs. Examples: polygons congruent, polygons similar, lines and planes parallel, lines and planes perpendicular
	65. Prove and use triangle inequality theorems.
	66. Develop proofs using coordinate methods.
Develop skills in logic necessary to make a logical argument.	67. Know necessary logical inferences. Example: If a conditional is true, then its contrapositive is true.
	68. Draw conclusions from syllogisms.
	69. Apply the structure and inferences of the conditional statement to reasoning.

UNIFIED GEOMETRY

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the geometric representation of statistical data.	70. Represent a set of statistical data. - Frequency polygon - Histogram 71. Draw a fitted line for data represented in a scatter plot. 72. Demonstrate an understanding of the vocabulary of statistics. - Population - Sample - Random variable - Discrete random variable - Continuous random variable 73. Recognize and draw probability distributions. Examples: uniform, discrete, normal 74. Recognize properties of distribution curves. Examples: skewness, kurtosis, symmetry 75. Determine relative location of mean, median, and mode of a distribution by examining the graph. 76. Apply probability principles to problem solving.

ALGEBRA II

Algebra II is an extension of the study of the number system that began in Algebra I. Emphases should be placed on functional notation and on understanding and use of algebraic structure and techniques. Elementary trigonometry, exponential and logarithmic functions, complex numbers, and matrices should be considered integral parts of the course content.

Students should master the ability to translate verbal statements into algebraic sentences. Verbal problems should be integrated into all areas in an effort to illustrate meaningful application of algebra to both career and consumer concerns. Use of the calculator is encouraged.

Algebra II is considered an essential elective for all college-bound students and follows Algebra I and Unified Geometry in the normal sequencing of courses. However, Unified Geometry should not be required as a prerequisite; and Algebra II and Unified Geometry could be taken concurrently.

ALGEBRA II

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the field of complex numbers.	1. Define sets of numbers. - Natural numbers - Integers - Rational numbers - Irrational numbers - Real numbers - Complex numbers
	2. Determine equality of complex numbers.
	3. Simplify a number within any subset of the set of complex numbers.
	4. Write the conjugate of a complex number.
	5. Determine the absolute value of a complex number.
	6. Perform operations with complex numbers in the form a + bi.
	7. Determine the nature of the solutions of a quadratic equation by examining the discriminant.
Demonstrate a basic understanding of matrices.	8. Identify a matrix as a rectangular array of numbers.
	9. Identify the zero and identity matrices.
	10. Determine the additive inverse of a given matrix.
	11. Add matrices.
	12. Evaluate the determinant.

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of algebraic measurement.	13. Apply appropriate algebraic properties in problem solving. 14. Use the distance formula to derive the midpoint formula. 15. Apply the distance and midpoint formulas to coordinate geometry.

ALGEBRA II

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the relationship between algebra and geometry.	16. Write the equation of a line when given two conditions. - Intercepts - Two points - Slope, point - Parallel line, point - Perpendicular line, point 17. Graph rational functions using symmetry and asymptotes. 18. Solve word problems using geometric concepts and shapes.
Demonstrate an understanding of conic sections.	19. Model the intersections of a plane and a cone to produce the conic sections. 20. Write the standard form of equations of conic sections. 21. Graph conic sections.

ALGEBRA II

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of algebraic equations and inequalities.	22. Solve equations and inequalities involving absolute value. 23. Solve equations involving complex numbers. 24. Graph the solutions of equations and inequalities. 25. Apply various methods of finding solutions to quadratic equations. - Factoring - Completing the square - Quadratic formula 26. Solve word problems that involve quadratic equations using calculators when appropriate. 27. Find zeros of a function. 28. Apply Descartes' Law of Signs to polynomial functions. 29. Approximate irrational zeros using the location principle. Use calculators when appropriate. 30. Write a polynomial function given its zeros. 31. Solve systems of equations and inequalities.

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of matrices.	32. Use augmented matrices to solve systems of equations.
	33. Use Cramer's Rule to solve a system of linear equations.
Demonstrate an understanding of the concept of polynomials.	34. Know and use the vocabulary associated with polynomials.
	35. Operate with polynomials, including polynomials with complex coefficients.
Demonstrate an understanding of rational algebraic expressions.	36. Perform operations on rational algebraic expressions.
	37. Define the domain of rational algebraic expressions.

ALGEBRA II

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the concepts of functions and other relations.	38. Know definitions and symbols associated with functions and other relations. - Domain - Range - Function notation(s) - Operations - Asymptotes - Periodic
	39. Identify and graph special functions. - Constant - Identity - Direct variation - Greatest integer - Absolute value - Polynomial - Rational
	40. Analyze the effects of parameter changes on the graphs of functions.
Demonstrate an understanding of exponential expressions.	41. Know and apply the laws of exponents.
	42. Simplify and perform operations with numbers whose exponents include both positive and nonpositive rational numbers.
	43. Solve exponential equations.
	44. Graph exponential functions using calculators when appropriate.
	45. Use the graph of an exponential function to estimate its value at a point.
Develop techniques for using logarithmic functions.	46. Translate exponential equations to logarithmic equations and vice versa.
	47. Know and apply the laws of logarithms.
	48. Use logarithmic notation.

ALGEBRA II

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop techniques for using logarithmic functions. (continued)	49. Solve logarithmic equations.
	50. Use linear interpolation as an application of approximation.
	51. Develop an awareness of natural logarithms.
Demonstrate an understanding of the concepts of trigonometric functions.	52. Know the definitions of the trigonometric functions, and recognize these functions as ratios of the sides of a right triangle.
	53. Define abscissa, ordinate, and radius vector of a point, and use the terms to determine the trigonometric functions of any angle in standard position.
	54. Identify the signs of the trigonometric functions in each of the four quadrants.
	55. Determine the intervals in which trigonometric functions are increasing or decreasing.
	56. Relate trigonometric functions and circular functions.
	57. Understand the relationship between degree and radian measure.
	58. Evaluate expressions involving degree and radian measure.
	59. Develop and know the values of the trigonometric functions of special and quadrantal angles.
	60. Graph the trigonometric functions.
	61. Determine period, amplitude, and phase shift of trigonometric functions.

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate the ability to apply trigonometric concepts.	62. Given a trigonometric value of an angle, determine its other trigonometric values.
	63. Derive trigonometric identities. - Inverse - Quotient - Pythagorean
	64. Simplify and evaluate trigonometric expressions.
	65. Verify trigonometric identities.
	66. Derive and use the Law of Sines and the Law of Cosines.
	67. Solve triangles. - Right - Oblique
	68. Determine the areas of oblique triangles.
	69. Apply multiple-angle formulas. - Sum/difference - Double-angle - Half-angle
	70. Solve equations (both algebraically and graphically) that involve trigonometric equations and their inverses. Use calculators and computers when appropriate.
	71. Use trigonometric functions to solve word problems. Use calculators and computers when appropriate.
Develop an understanding of sequences and series.	72. Recognize number patterns as sequences.
	73. Recognize number sequences as functions.

ALGEBRA II

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will Develop an understanding of sequences and series. (continued)	Students will 74. Recognize and determine features of arithmetic and geometric sequences and series. - First term - Common difference or ratio - Nth term - Means - Sigma notation 75. Express a repeating decimal as a geometric series. 76. Determine the sum of finite and infinite series. 77. Use sequences and series to solve word problems. Use calculators and computers when appropriate.

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of logic applied to algebra.	78. Use the terminology of set theory to express solutions for algebraic sentences.
	79. Prove theorems using algebraic properties and techniques.
	80. Use union or intersection to express solutions of inequalities.

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of statistics.	81. Demonstrate an understanding of the vocabulary of statistics. - Population - Sample - Random variable - Population parameter - Statistic
	82. Compute and use measures of variability. - Range - Variance - Standard deviation
	83. Determine quartiles for a set of data.
	84. Recognize outliers in a set of data.
Demonstrate an understanding of probability.	85. Define a permutation of n objects.
	86. Define a combination of n objects.
	87. Find the combination and permutation of n objects taken r at a time.
	88. Select the appropriate counting procedure to solve probability problems.
	89. Develop an awareness of the partitions rule.
	90. Use rules of probability.

ADVANCED MATHEMATICS

Advanced Mathematics is designed as a college-preparatory course to follow successful completion of Algebra I, Unified Geometry, and Algebra II. The course provides the necessary prerequisites for college mathematics. Emphasis is placed on strong reinforcement of the basic concepts of college-preparatory mathematics so that students will have the foundation needed to assure continued success in mathematics courses. The use of calculators is encouraged in order that students may concentrate on higher-order thinking skills, and so that they may perform easily the computations of numbers presented in realistic application problems.

ADVANCED MATHEMATICS

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of the concept of a number system.	1. Define a system.
	2. Define a number system.
	3. Apply the field properties for binary operations. - Closure - Associativity - Existence of identities - Existence of inverses - Commutativity - Distributivity
	4. Determine whether a given system is a semigroup, a group, or a field.
	5. Use the axioms of equality. - Prove theorems - Verify statements - Verify steps in problems
	6. Use the axioms of order. - Prove theorems - Verify statements - Verify steps in problems
Demonstrate an understanding of complex numbers.	7. Demonstrate an understanding of the relationship between vectors and complex numbers.
	8. Add and multiply complex numbers using their vector forms.
	9. Express complex numbers in trigonometric form.
	10. Use DeMoivre's Theorem. - Raise complex numbers to powers - Find roots of complex numbers

ADVANCED MATHEMATICS

AREA: NUMBER

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Develop an understanding of matrices.	11. Review the characteristics of matrices.
	12. Perform operations with matrices.
	13. Determine if field properties are true for matrices.

ADVANCED MATHEMATICS

AREA: MEASUREMENT

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate ability to use measure in problem solving.	14. Determine measure as a part of problem solving.
	15. Develop an understanding of the derivative as a rate of change.

ADVANCED MATHEMATICS

AREA: GEOMETRY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of conic sections.	16. Identify the conic section for a given equation. 17. Determine characteristics of conic sections. - Vertices - Axes of symmetry - Directrix - End-points of axes - Latera recta - Eccentricity 18. Determine equations of conic sentences when given characteristics. 19. Graph second degree equations. 20. Identify degenerate conics.

ADVANCED MATHEMATICS

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of exponential and logarithmic functions.	21. Use the laws of exponents as they apply to all real numbers.
	22. Develop an awareness of natural logarithms.
	23. Use linear interpolation in approximating values of functions.
	24. Apply the laws of logarithms.
Demonstrate an understanding of methods used to solve equations.	25. Apply the Fundamental Theorem of Algebra to solve polynomial equations.
	26. Solve matrix equations using calculators and computers when appropriate.
	27. Solve equations. - Logarithmic - Exponential
	28. Use linear transformations.
	29. Solve systems of equations. - Linear/quadratic - Quadratic
Demonstrate an understanding of polynomials.	30. Know and apply the Remainder Theorem, the Factor Theorem, and the Rational Root Theorem.
	31. Use synthetic division to find the zeros of a polynomial function.
	32. Use Descartes' Law of Signs to determine the number of real roots.
	33. Determine the upper and lower bounds for the real roots.

ADVANCED MATHEMATICS

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of linear programming.	34. Solve problems involving maximum or minimum values by using linear programming procedures.
Demonstrate an understanding of vector algebra.	35. Define a vector as an ordered n-tuple. 36. Distinguish between a scalar and a vector. 37. Perform vector operations. - Displacements - Addition - Differences - Scalar multiplication - Dot products - Cross products 38. Deduce the properties for vector addition. - Commutativity - Associativity - Identity - Additive inverse 39. Determine the norm of a vector. 40. Identify unit vectors. 41. Determine coincidence, parallelism, collinearity, and perpendicularity of lines using vectors. 42. Express a vector as the sum of its component vectors. 43. Determine vector equations of a line. 44. Identify the line specified by a vector equation.

AREA: ALGEBRA

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of vector algebra. (continued)	45. Use vectors to determine the distance between a point and a line.
	46. Use vectors to determine the point of intersection of two lines.
	47. Use vectors to determine the slope of a line.

ADVANCED MATHEMATICS

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of functions.	48. Define a function in terms of a relation and as a mapping.
	49. Graph special functions. - Signum function - Greatest integer function - Absolute value function
	50. Recognize the equality of functions.
	51. Analyze the effects of parameter changes on the graphs of functions.
	52. Perform operations with functions. - Sums - Differences - Products - Quotients - Powers - Compositions
	53. Know the special properties of constant functions and the identity function.
	54. State the properties of functions. Examples: increasing/decreasing, continuity, odd/even, one-to-one, periodic
	55. Determine the inverse of a function.
	56. Sketch the graph of polynomial functions. - Limits and continuity - Location principle - Direction of a curve at one of its points
	57. Use Horner's Method to evaluate a polynomial.
	58. Find the slope, and write the equation of the line tangent to and normal to a function at a point.

ADVANCED MATHEMATICS

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of circular functions.	59. Use the coordinates of a point (abscissa, ordinate) on the radius vector that generates the unit circle to define the six trigonometric functions.
	60. Determine the signs of the values of trigonometric functions in each of the four quadrants.
	61. Approximate values of trigonometric functions using linear interpolation or scientific calculators.
	62. State the amplitude, period, and phase shift of trigonometric functions.
	63. Give domain and range of inverse circular functions.
	64. Graph inverse circular functions.
	65. Verify trigonometric identities.
	66. Use the sum and difference formulas to determine values of trigonometric functions.
	67. Use formulas to find values of trigonometric functions. - Sum/difference - Double angle - Half angle - Reduction
	68. Develop an understanding of polar graphs.
	69. Define polar coordinates.
	70. Express Cartesian coordinate points in polar form and vice versa.
	71. Express complex numbers using polar coordinates.
	72. Graph polar equations.

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of circular functions. (continued)	73. Solve right and oblique triangles.
	74. Solve equations involving circular functions.
	75. Use circular functions to solve word problems. Use scientific calculators.
Demonstrate an understanding of sequences, series, and limits.	76. Express sequences in various forms. Examples: recursively, by expressing a_n in terms of n.
	77. Find the common difference, the nth term, and arithmetic means of arithmetic sequences.
	78. Distinguish between sequences and series.
	79. Find the sum of n terms in an arithmetic series or a geometric series.
	80. Find the common ratio, the geometric means, and the nth term of geometric sequences.
	81. Use the Binomial Theorem to expand binomials.
	82. Find the nth term in binomial expansions.
	83. Use Pascal's Triangle to determine coefficients of expanded binomials.

ADVANCED MATHEMATICS

AREA: PATTERNS AND FUNCTIONS

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of sequences, series, and limits. (continued)	84. Find the limit of sequences.
	85. Determine convergence or divergence of sequences.
	86. Find the sum of infinite geometric series.
	87. Understand the concept of increasing and deceasing functions.
	88. Determine continuity of functions.
Demonstrate an understanding of the basic concepts of calculus.	89. Define the derivative of a function.
	90. Determine the derivatives of polynomials, using the limit concept.
	91. Solve problems that make application of derivatives. - Relative maximum points - Relative minimum points - Inflection points - Concavity
	92. Utilize Newton's Method of approximating zeros.

ADVANCED MATHEMATICS

AREA: LOGIC

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of logical inference.	93. Use the vocabulary for symbolic logic.
	94. Determine the validity of statements using truth tables. - Conditionals - Converses - Inverses - Contrapositives - Compound statements - Biconditionals - Negation - Conjunction - Disjunction
	95. Use symbolic logic to explain inference. - Detachment - Contraposition - Syllogism - Substitution
	96. Apply logical vocabulary to the understanding of theorems. - p implies q - q if p - p only if q - p is sufficient for q - q is necessary for p
	97. Use mathematical induction as a method of proof.
	98. Use contradiction as a method of proof.

ADVANCED MATHEMATICS

AREA: STATISTICS AND PROBABILITY

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
Students will	Students will
Demonstrate an understanding of probability and statistics.	99. Demonstrate an understanding of sampling. - Random - Biased
	100. Compute z scores.
	101. Evaluate and interpret data in terms of standard normal values.
	102. Demonstrate an understanding of term expected value.
	103. Compute confidence intervals for normally distributed populations.
	104. Demonstrate an understanding of confidence intervals.
	105. Develop an understanding of hypothesis testing.
	106. Use hypothesis testing. - Test a mean - Test a proportion
	107. Use counting rules.
	108. Apply rules of probability.

ADDITIONAL COURSES

School systems in which some students complete a college-preparatory sequence before their senior year should consider the advisability of offering Advanced Placement Calculus, Statistics, and/or Discrete Mathematics as electives for students in grade twelve.

ADVANCED PLACEMENT MATHEMATICS

CALCULUS AB AND CALCULUS BC

Advanced Placement mathematics consists of a full academic year of work in calculus and related topics comparable to courses in colleges and universities.

Calculus AB is an Advanced Placement course appropriate for twelfth grade students. The curriculum should include all prerequisites for a one-year course in elementary functions and calculus. A major concentration of the course work should be on topics in differential and integral calculus.

Calculus BC can be offered only by those schools that are able to complete thorough coverage of elementary functions in addition to prerequisites for Calculus AB before grade 12. The course consists of an intensive full year of work in the calculus of functions of a single variable. In addition to the topics covered in Calculus AB, the course includes other topics such as infinite series and differential equations.

If schools offer one or both of the Advanced Placement courses in calculus, the curriculum must be designed so that a full preparatory program can be completed by Advanced Placement candidates no later than the end of grade 11. This can be accomplished by starting the study of secondary school mathematics in grade 8, reorganizing the content of courses, or establishing accelerated sections for the more capable students. It is highly desirable, therefore, that potential Advanced Placement candidates be identified and placed in appropriate mathematics courses as early as possible.

Calculus AB and Calculus BC represent college-level mathematics for which many colleges grant advanced placement and credit.

RELATED READING

Working Groups of the Commission on Standards for School Mathematics of the National Council of Teachers of Mathematics. Curriculum and Evaluation Standards for School Mathematics. Reston, Va.: NCTM, 1989.

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Board on Mathematical Sciences, Mathematical Sciences Education Board, National Research Council. Everybody Counts: A Report to the Nation on the Future of Mathematics Education. Washington, D.C.: National Academy Press, 1989.

APPENDIX A

TIME REQUIREMENTS FOR SUBJECT AREAS

STUDY HABITS, HOMEWORK, AND STUDENT RESPONSIBILITIES

TIME REQUIREMENTS FOR SUBJECT AREAS

In accordance with # 1.1.5 (Action Item # F-1) adopted by the Alabama State Board of Education on February 23, 1984, which directs the State Courses of Study Committee to include time requirements in the State Courses of Study, the following recommendations are made:

THE TOTAL INSTRUCTIONAL TIME OF EACH SCHOOL DAY IN ALL SCHOOLS AND AT ALL GRADE LEVELS SHALL EQUAL 6 HOURS OR 360 MINUTES EXCLUSIVE OF LUNCH PERIODS, RECESS, OR TIME USED FOR CHANGING CLASSES.

THE FOLLOWING MINIMUM TIME ALLOTMENTS SHALL BE FOLLOWED:

SUBJECT AREA	GRADES 1-3	GRADES 4-6
Language Arts Spelling, Grammar, Listening, Handwriting Composition, Speaking	60 minutes daily	60 minutes daily
Reading	90 minutes daily	60 minutes daily
Mathematics	60 minutes daily	60 minutes daily
Science	30 minutes daily	45 minutes daily
Social Studies	30 minutes daily	45 minutes daily
Physical Education	30 minutes daily	30 minutes daily
Humane Treatment of Animals	20 minutes weekly	20 minutes weekly
Health	60 minutes weekly	60 minutes weekly
*Art	60 minutes weekly	60 minutes weekly
*Music	60 minutes weekly	60 minutes weekly
*Computer Literacy	60 minutes weekly	60 minutes weekly

*Note: The areas of Art and Music, as well as Computer Literacy, may be incorporated into other subject areas or taught separately on a rotating basis.

GRADES 7-12

A minimum of 140 clock hours of instruction is required for one Carnegie unit of credit. A time allotment of either 50 minutes per day or 250 minutes per week will satisfy this requirement and still allow for flexible scheduling. This requirement applies to those schools which are not accredited as well.

In those schools where grades 7 and 8 are housed with other elementary grades, the school may follow the time requirements listed for grades 4-6 or the time requirements listed for grades 7-12.

REMEDIAL AND/OR ENRICHMENT ACTIVITIES

Remedial and/or enrichment activities should be a part of the time schedule for the specific subject area.

KINDERGARTEN

In accordance with Ala. Admin. Code r 290-050-010-.02-.11 Alabama Kindergartens, the overall daily time schedule of the kindergarten shall be the same as the schedule of the elementary schools in the system of which they are a part. In setting up a child's schedule, consideration should be given to rest periods and variety in activities. The schedule should provide some time for the childto follow individual interests in a relaxed, unhurried atmosphere. The schedule should be flexible and not followed in such a manner as to cause tension or a feeling of pressure on the part of the child. In a well-planned kindergarten program, a child should enjoy and profit from a full-day's activity.

STUDY HABITS, HOMEWORK, AND STUDENT RESPONSIBILITIES

Through classroom activities, students should learn to understand and accept responsibility and to value the importance and dignity of work. Students need to become aware that their competency increases their ability to achieve desired goals and to function as responsible citizens. Early in school, students should learn that work and responsibility are important aspects of growing up. They should take pride in work well done.

It is important for students to see how their relationships with adults and classmates affect their performance and success in school. When students become responsible persons, they learn to accept and solve problems, as well as to trust in their own abilities. This acceptance of responsibility helps to make their relationships with others more meaningful and satisfying.

Guidelines for promoting appropriate student behaviors which lead to acceptance of responsibility should be developed by local boards of education. These guidelines should focus on giving students a sense of ownership or investment in their education. Lessons should include emphasis on student responsibility and evidence of student progress in accepting responsibility.

In relation to the understanding and acceptance of responsibility and to the value of the work ethic, students should learn to study effectively and to apply problem solving and critical thinking skills. Student responsibility in the learning process must be clearly defined. The use of study skills and homework should be a part of every student's instructional plan.